Ohio Agricultural Experiment Station.

BULLETIN 47.

WOOSTER, O., DECEMBER, 1892.

...AND. .

ELEVENTH ANNUAL REPORT

FOR 1892.

The Bulletin of this Station is sent free to all residents of the state who request it. Persons who receive duplicate copies of the Bulletin, or who do not care to receive any, are requested to notify the Station as the edition is not sufficient to supply the urgent demand for it. All correspondence should be addressed to EXPERIMENT STATION, *Wooster, Ohio.*

NORWALK, OHIO
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1893

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ELEVENTH ANNUAL REPORT

OF THE

OHIO AGRICULTURAL

EXPERIMENT STATION,

FOR 1892.

PRINTED BY ORDER OF THE STATE LEGISLATURE.

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THE GOVERNOR OF THE STATE, THE DIRECTOR OF THE STATION,	*Ex-Officio.*

OFFICERS OF THE BOARD.

SETH H. ELLIS,	President.
PROF. WILLIAM R. LAZENBY,	Secretary.
BERTHA E. WILDMAN,	Treasurer.

STATION STAFF.

CHARLES E. THORNE,	Director.
WILLIAM J. GREEN,	Horticulturist and Vice-Director.
J. FREMONT HICKMAN, M. A. S.,	Agriculturist.
FRANCIS M. WEBSTER,	Entomologist.
BERTHA E. WILDMAN,	Bursar.
EDWIN C. GREEN,	Assistant Horticulturist.
F. J. FALKENBACH,	Chemist and Meteorologist.

ANNOUNCEMENT.

The Ohio Agricultural Experiment Station is organized under an act of the General Assembly of Ohio, passed April 17th, 1882, and supplemented by an act of Congress, approved March 2, 1887.

The Station is prepared to test new varieties of grains, fruits and garden vegetables; to examine seeds that are suspected of being unsound or adulterated; to identify and name grasses, weeds and other plants; to identify insects and suggest measures for the control of such as are injurious, and to give advice concerning the prevention of the fungoid diseases which affect vegetation.

The Station is not prepared to furnish analyses of chemical or commercial fertilizers, as in Ohio that work is performed under direction of the Secretary of the State Board of Agriculture at Columbus; but the Station will at all times respond to requests for advice concerning the use of such fertilizers.

The Station is not prepared to examine foods and dairy products suspected of adulteration, as that work is provided for in the Ohio Dairy and Food Commission, whose headquarters are at Columbus.

The Station is not at present prepared to offer advice or treatment for contagious animal diseases, but would refer all seeking such assistance to the Ohio Live Stock Commission, at Columbus.

Any citizen of Ohio has the right to apply to the Station for any information it can render, and all such applications will receive prompt attention.

Visitors to the Station are always welcome.

Address all communciations to

EXPERIMENT STATION, *Wooster, Ohio.*

Eleventh Annual Report.

REPORT OF THE BOARD OF CONTROL.

To Hon. WILLIAM MCKINLEY, JR., *Governor of Ohio:*

SIR:—The Board of Control of the Ohio Agricultural Experiment Station herewith submits the eleventh annual report of the Station for the year 1892.

REMOVAL OF THE STATION.

In the annual report for 1891 was given a copy of the law authorizing the removal of the station, together with an account of action under this law, by which a site in Wayne county, near the city of Wooster, had been chosen as the future home of the Station.

A portion of the land purchased for the use of the Station was occupied on the first of April, and the remainder at different dates, later in the season, the final removal of the Station from Columbus taking place in September.

LITIGATION AFFECTING THE STATION.

The bonds of Wayne county for $85,000, issued under authority of the law above mentioned, for the purchase and improvement of land within the county for the use of the Station, were sold at a premium. This premium the county commissioners offered for deposit in the county treasury, but the treasurer refused to accept it, holding the law authorizing the issue of the bonds to be unconstitutional. The commissioners instituted mandamus proceedings, and the treasurer brought action to enjoin the commissioners from levying the tax provided for the payment of the bonds, to which the commissioners replied by demurrer.

The common pleas and circuit courts both sustained the commissioners in both suits; but the supreme court, in a decision promulgated in November, reversed the decisions of the lower courts, dismissing the mandamus suit and overruling the demurrer in the injunction suit and remanding this case to the lower court "for further proceedings according to law." From this decision Judge Minshall dissented. Following is the syllabus of the decision:

"3,084. R B. Wasson et al. *vs.* Board of Commissioners of Wayne county et al. Error to the Circuit Court of Wayne county.

Spear, C. J.: 1. A law, which provides for the location and construction of an institution to be controlled wholly by a Board appointed by the Governor, and for the furnishing of information to the people of the State at large, as to the work of such institution exclusively by the Board and State officers at the expense of the State, is a law in general and not of local character, notwithstanding incidental benefits may accrue to property near such institution by reason of its location, and money raised by taxation for the purchase of a site and the construction of buildings is general revenue for the State.

2. Under section 2 of article 12 of the constitution, which provides that "laws shall be passed taxing by a uniform rule all moneys, credits, and also real and personal property according to its true value in money," all taxes for general revenue for the State must be levied by a uniform rule upon all the taxable property within the State.

3. The act of April 23, 1891, which attempts to authorize any county of the State to raise money to secure the location therein of the Ohio Agricultural Experiment Station by a tax upon all the taxable property within such county is in contravention of section 2, of article 12 of the constitution, and is, therefore, void.

Judgments reversed."

The question now before the courts is whether the collection of this tax can be prevented, since no legal objection was raised until after the bonds had been sold and proceeds used as required by law and thereby distributed into the various channels of business.

THE STATION'S LOCATION.

The Board of Control has every reason to believe that the obstructive litigation above referred to is not indorsed by even a respectable minority of the citizens of Wayne county, but that the people of the county as a whole desire to have the Station located in their midst, and stand ready to redeem their pledge, made at the polls in October, 1891. In the decisions of the Supreme courts of Ohio and other states ample justification is found for the expectation that, notwithstanding the fact that the law in question has been declared unconstitutional, yet the proceedings which were conducted under it in good faith and without legal objection must be ratified, and therefore that the tax will be collected and the bonds redeemed as provided by the law. Should this expectation be justified by subsequent events the Station will be as much bound to abide in Wayne county as though the constitutionality of the law had never been questioned, for the decision of the Supreme court affects the taxing clause only.

The Board of Control fully recognizes the advantage of a central location for the Station, with respect to state boundaries; and it is quite possible that some other location would have been chosen, had the General Assembly appropriated a sum sufficient for this purpose and permitted the selection of a site without reference to local donations of money. It is nevertheless true that the location selected combines advantages which can be secured at only a very limited number of localities in the State.

Under these circumstances, the Board of Control is unanimous in the opinion that the interests of the State and of the Station would alike suffer far greater loss from the sacrifice of property and the inevitable delay and retarding of important work, which would be involved in the attempt to re-locate the Station, than would be compensated by any possible gain from such re-location.

IMPROVEMENTS BEGUN.

Acting in this belief, the Board of Control, on July 8, contracted with the firm of Stence, Sheppard and Ames for the erection of a block of five greenhouses, covering 80x101 feet, with a stone boiler house and office attached, 24x44 feet in size, one and one-half story high, together with a separate one story stone building, 18x34 feet in size, with two greenhouses in the rear, each 14x28 feet, this smaller building being designed for the laboratory study of insects and diseases of plants. The contract price of these buildings was $11,050.00; but this does not include excavation, architect's fees, superintendence, water supply, heating apparatus, ventilating apparatus and benches. It is estimated that these items will cost about three thousand dollars, raising the total cost of the completed buildings to about $14,000. It was the intention to pay for these buildings out of the balance of the Wayne county donation, left after the purchase of land, and which amounts to $26,262.66, the entire fund arising from this donation having been appropriated to the order of the Board of Control without restriction, in a special act of the General Assembly passed February 10, 1892.

These buildings have been constructed according to contract, but the contractors have not yet received a dollar of their pay, owing to the fact that the Auditor of State has refused to honor the requisitions of the Board of Control upon the Wayne county fund, basing his action upon the fact that in the general appropriation bill of last winter the items for the improvement of the Station farm (amounting to $25,500.00) were made conditional upon the ratification by the Supreme Court of the law, authorizing the counties to raise money by taxation to secure the location of the Station.

It is hoped that the General Assembly will provide for the release of this fund at the earliest date possible.

ADDITIONAL IMPROVEMENTS NEEDED.

In our last annual report it was stated that the balance of the Wayne county donation would be used in the erection of a main office building for the Station. An architect was employed and plans were prepared for a fire-proof building for this purpose, and bids were invited for its construction. These bids were opened June 1st, but all were found to be far in excess of the funds available for the work, and therefore the plans

for this building were temporarily laid aside and the greenhouses and insectary, already described, were erected instead.

The need of this main building is imperative, and for this and other improvements, all urgently needed, the following appropriations are requested:

Main office building	$45,000 00
Main barn	15,000 00
Fencing and drainage	2,000 00
Stock for fruit and forestry planting	1,000 00

We also ask for an appropriation of $500.00 for expenses of the Board of Control.

The balance of the Wayne county donation, after paying for the greenhouses and insectary, will be required for other items of improvement and outfit, enumerated in our report of last year.

PERSONNEL OF THE STATION.

No change has been made in the Board of Control during the year, Col. Brigham having been reappointed at the expiration of his term of office in May.

At the beginning of the year Mr. F. J. Falkenbach was appointed chemist to the Station and Mr. E. C. Green was promoted to the position of assistant horticulturist. Since the first of July, Mr. F. M. Webster has given his services wholly to this Station. Mr. W. H. Baker, meteorologist, severed his connection with the Station at the end of June, and Miss Freda Detmers, botanist, was unable to accompany the Station on its removal to Wooster. Both these officers had served the Station faithfully and well, and their withdrawal is felt to be a serious loss.

SUB-STATIONS.

The Sixty-ninth General Assembly appropriated $1,000 for substations for field experiments with fertilizers. This appropriation was held until the location of the central station should be definitely fixed, but is now being expended in preparing for experiment a tract of forty acres, leased for ten years for this purpose, and lying in what is known as the "oak openings" region of northwestern Ohio, this tract being in Fulton county, near the corners of Lucas and Henry counties. The soil of this region, which includes several hundred square miles, consists chiefly of yellow sand, and is totally different in character from that of the station farm. Aside from the light which systematic experiments made in this region should throw upon the management of this particular soil, they will have added value as a check upon similar investigations conducted on soils of a different character.

It is hoped that way may open for the establishment of similar sub-stations upon the clay soil which covers so large a portion of the northeastern counties, and upon some of the less productive soils of the southern part of the State.

WILLIAM R. LAZENBY,
Secretary of Board of Control.

REPORT OF THE TREASURER.

Hon. S. H. ELLIS, *President Board of Control:*

SIR:—The financial report of this Station for the fiscal year ending June 30, 1892, is herewith respectfully submitted:

An itemized statement of our account with the annual appropriation received from the U. S. Treasury is shown in statement A, this being a copy of the report made to the Governor of the State and the Secretary of the U. S. Treasury.

Our account with the produce fund is shown in statement B.

Statement C is a statement of account with the State Treasurer, showing the dates, purposes and amounts of the appropriations and the balance remaining in the treasury to the Station's credit June 30, 1892.

A statement of account, with the donation received from the commissioners of Wayne county, for the purchase of a home for the Station within the limits of that county, is shown in statement. D.

STATEMENT A.

THE OHIO AGRICULTURAL EXPERIMENT STATION IN ACCOUNT WITH THE UNITED STATES TREASURY.

Dr.

1892.	
To receipts from Treasurer of the United States, as per appropriation for year ending June 30, 1892, under act of Congress approved March 3, 1887	$15,000 00

Cr.

June 30, by salaries	$8,270 00	
" labor	2,916 79	
" supplies	1,179 30	
" freight and expressage	2 10	
" tools and implements	259 65	
" live stock	10 00	
" fencing and drainage	5 74	
" furniture and general fittings	89 04	
" technical apparatus and supplies	468 53	
" library	311 46	
" printing, postage and stationery	1,012 99	
" travel and incidentals	220 75	
" buildings	253 65	
Total		$15,000 00

We, the undersigned, duly appointed auditors for the corporation, do hereby certify that we have examined the books and accounts of the Ohio Agricultural Experiment Station for the fiscal year ending June 30, 1892; that we have found the same well kept and correctly classified as above, and that the receipts for the time named are shown to have been $15,000.00, and the corresponding disbursements $15,000.00, for all of which proper vouchers are on file, and have been by us examined and found correct.

S. H. ELLIS,
R. H. WARDER,
Auditors, Board of Control.

I hereby certify that the foregoing statement of account to which this is attached, is a true copy from the books of account of the institution named.

BERTHA E. WILDMAN,
Treasurer, Board of Control.

STATEMENT B.

OHIO AGRICULTURAL EXPERIMENT STATION IN ACCOUNT WITH PRODUCE FUND.

TO RECEIPTS.

Dr.

1892.			
June 30,	from sales of milk	$2,897 08	
"	" agricultural products	1,368 33	
"	" horticultural products	1,753 94	
"	labor	42 52	
"	rent	112 50	
"	miscellaneous sales	69 50	
	Total receipts for the year		$6,243 87
To balance brought forward July 1, 1891			120 21
	Total		$6,364 08

BY EXPENDITURES.

Cr.

1892.			
June 30,	for labor	$4,993 33	
"	supplies	680 23	
"	freight and expressage	94 36	
"	tools and implements	3 82	
"	live stock	105 20	
"	furniture and general fittings	115 05	
"	technical apparatus and supplies	7 88	
"	library	29 85	
"	printing, postage and stationery	20 67	
"	travel and incidentals	275 23	
"	buildings (labor, $26.36, material, $2.25)	28 61	
	Total expenditures		$6,354 23
By balance carried forward			9 85
	Total		$6,364 08

STATEMENT C.

STATEMENT OF ACCOUNT OF THE OHIO AGRICULTURAL EXPERIMENT STATION WITH STATE TREASURY.

Date of appropriation.	Appropriation for—	Receipts.	Expenditures.	Balance in treasury June 30, 1892
1891	Fire-proof safe, office furniture and museum cases	$ 800 00	$ 367 25	$ 432 75
	Field experiments with insect enemies and fungous diseases of plants	600 00	600 00	.....
	Sub-station for field experiments with fertilizers	1,000 00	....	1,000 00
	Repairs and improvements	300 00	300 00	.....
	Expenses of Board of Control	200 00	200 00	.....
	Illustrating bulletin	500 00	118 60	381 40
1892	Spraying experiments	500 00	.....	500 00
	Expenses of Board of Control	372 24	278 10	94 14
	Total for 1891 and 1892	$ 4,272 24	$ 1,863 95	$ 2,408 29
	Balance of appropriations for 1890, brought forward July 1, 1891—			
	For finishing and furnishing museum and library	176 71	176 71	.....
	For expenses of Board of Control	95 85	95 85	.....
	Totals	$ 4,544 80	$ 2,136 51	$ 2,408 29

STATEMENT D.

OHIO AGRICULTURAL EXPERIMENT STATION IN ACCOUNT WITH DONATION FROM WAYNE COUNTY.

RECEIPTS.

1892.

From Commissioners of Wayne county $85,000 00

EXPENDITURES.

June 30, for farm in Wayne county	$58,578 25	
" surveyor's and abstractor's fees	49 90	
		$58,628 15
By balance, carried forward		26,371 85
Total		$85,000 00

The above four statements are combined in the following statement E, which shows the total income and expenditures of the Station for the fiscal year:

STATEMENT E.

TOTAL RECEIPTS AND EXPENDITURES OF THE OHIO AGRICULTURAL EXPERIMENT STATION FOR THE YEAR ENDING JUNE 30, 1892.

RECEIPTS.

From U. S. Treasury	$15,000 00	
" farm produce, etc	6,243 87	
" State appropriations for 1891	3,400 00	
" " " " 1892	872 24	
" donation of Wayne county	85,000 00	
Total receipts		$110,516 11
Balance brought forward July 1, 1891		392 77
Total		$110,908 88

EXPENDITURES.

For salaries	$8,2 0 00	
" labor	8,248 72	
" supplies	1,984 50	
" freight and expressage	96 46	
" tools and implements	320 47	
" live stock	115 20	
" fencing and drainage	5 74	
" furniture and general fittings	571 34	
" technical apparatus and supplies	476 41	
" library	341 31	
" printing, postage and stationery	1,152 26	
" travel and incidentals	575 41	
" buildings (material and labor)	758 97	
" expenses Board of Control	573 95	
" farm in Wayne county	58,628 15	
Total expenditures		$82,118 89
By balance, carried forward		28,789 99
Total		$110,908 88

PERMANENT IMPROVEMENTS

From the total expenditures, shown in statement E, the following amounts were used in permanent improvements on the farm at Columbus:

STATEMENT F.

Buildings, (material and skilled labor)	$694 60	
" (ordinary labor)	64 37	
Fencing and drainage, (repairs)	5 74	
Total		$764 71

BERTHA E. WILDMAN,
Treasurer.

REPORT OF THE DIRECTOR.

Hon. S. H. ELLIS, *President of the Board of Control*:

SIR The eleventh annual report of the Ohio Agricultural Experiment Station, for the year 1892, is respectfully submitted, this being my fifth report as Director:

THE SEASON.

During the first half of the growing season, rainy weather prevailed almost incessantly over Ohio, especially over the middle and northern portions of the state. On the undrained, flat lands of the central counties many fields intended for corn were abandoned, after having been partly prepared, and many more received such insufficient cultivation that the crop was almost a failure. At one time it seemed impossible that sufficient corn could be produced for home consumption, yet such is the recuperative power of this plant that a fair crop was finally harvested over the State as an average.

THE STATION'S WORK.

Last winter the General Assembly appropriated $500 to be used by the Station in continuing experiments in the control of insects and fungous diseases of plants. Arrangements were made to continue these experiments on the lines followed the previous season, with such modifications as experience had indicated. At one time it seemed that the whole work would be rendered abortive by the continuous rains, but the final results, given in the report of the Horticulturist, show that the actual benefit from spraying orchard trees may be even greater in a wet season than in a dry one.

In other lines of work the object has been to gain further evidence respecting questions already under investigation; for each season's experience more fully exhibits the necessity of piling test upon test in agricultural experiment.

REMOVAL OF THE STATION.

The transfer of our base of operations to the new home of the Station in Wayne county has necessarily involved a large expenditure of energy that would otherwise have gone into the proper work of the

Station. This transfer was delayed until after wheat harvest, in order to complete the field tests of the season with the wheat crop. On the first of September the headquarters of the Station were removed from Columbus to Wooster, and since that date we have been engaged in preparing the farm here for experimental work. This preparation has been seriously impeded by the refusal of the Auditor of State to permit the withdrawal from the State treasury of the funds donated by Wayne county for the improvement of the farm, and a year's loss of time in some of the most important work of the Station will be the result.

NEW BUILDINGS

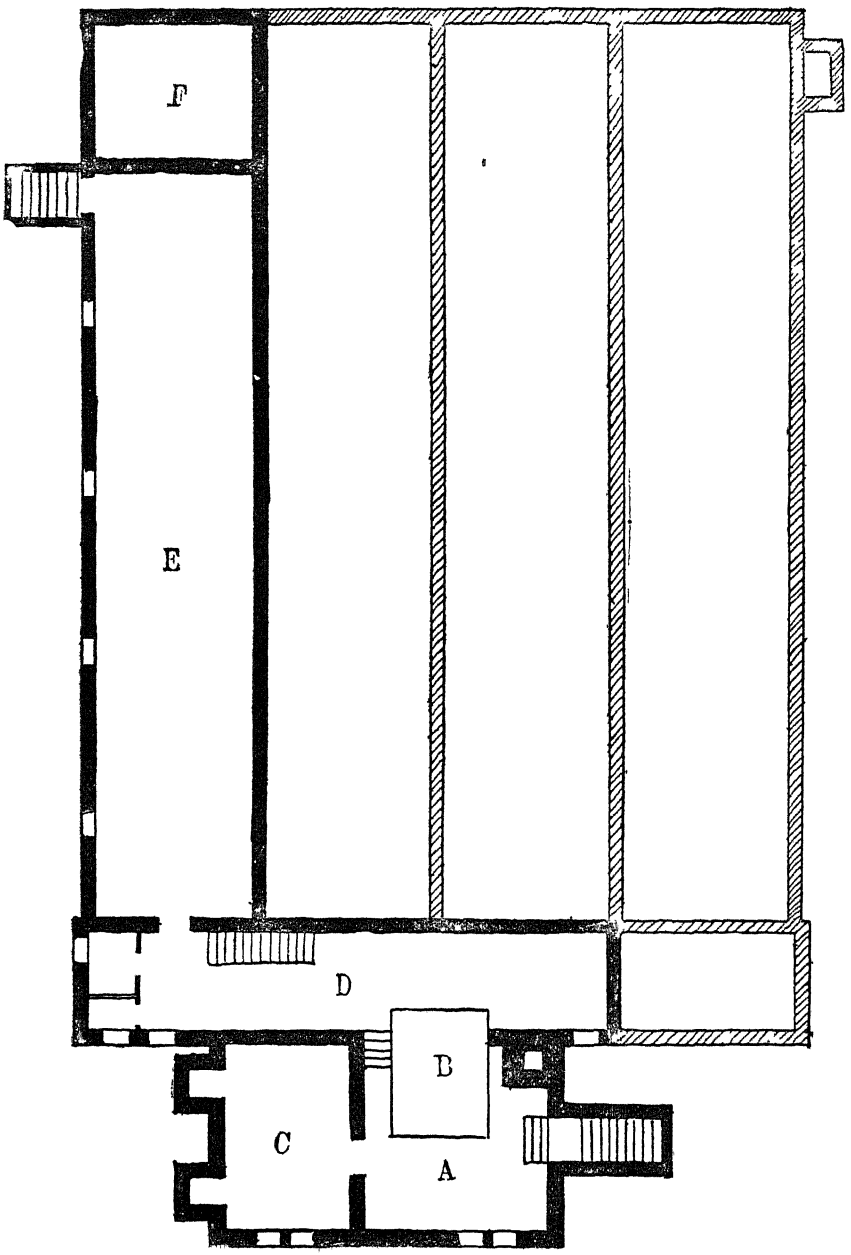
The equipment of the new Station at Wooster has been commenced by the erection of two buildings, the one a combination of boiler house, greenhouses and greenhouse offices, shown in plans I and II, and the other a building to be devoted to the study of insects and fungous diseases of plants, shown in plan III.

The boiler house is a stone building, 24 x 40 feet in size, one and one-half story high, with a deep basement to contain the boilers. It is proposed to heat from these boilers not only the greenhouses in the rear of the boiler house, but also the main building of the Station, to be hereafter erected, and which will be located in front of the boiler house.

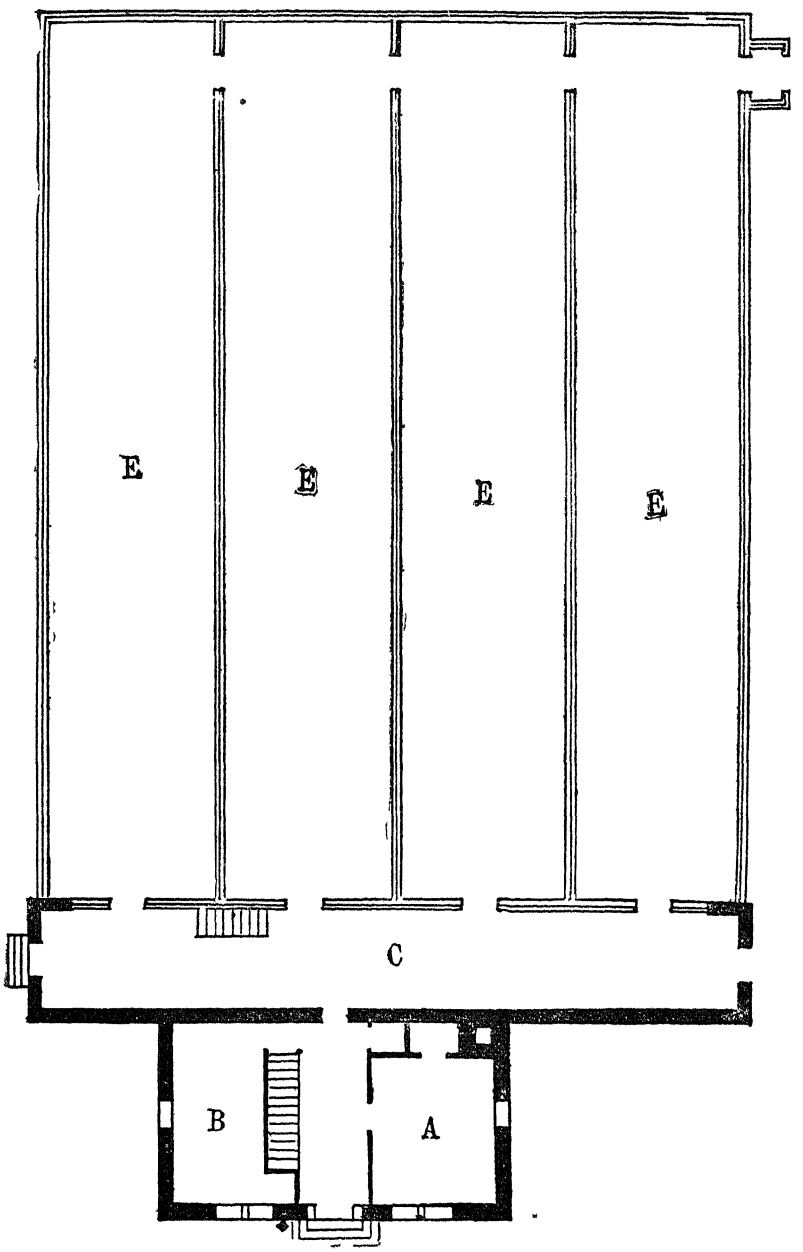
In plan I, A is the boiler room; B, boilers, C, coal room; D, cellar under arcade (for distribution of heating pipes and passage); E, mushroom cellar, F, cistern.

In plan II, A is an office; B, seed room; C, arcade; E, E, E, E, greenhouses. The "arcade" is roofed with tin over the part joining the boiler house, so that this part may be used as a potting room. The stairway in the main hall leads to a hall above, on each side of which is a room designed for janitor's or assistant's use.

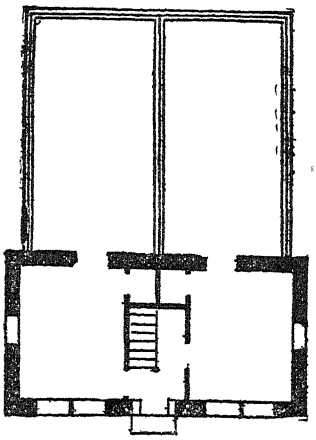
In plan III, the front part is a one story stone building, 18 by 34 feet in size, containing two small laboratories, separated by hall and stairway, and each opening into a greenhouse in the rear, 14 x 28 feet in size.



PLAN I.—Basement and foundation of boiler house and greenhouses.



PLAN II.—Ground floor of boiler house and greenhouses



PLAN III —Insectary

The stone used in these buildings is a yellowish sandstone, slightly tinged with green, found on the premises. The greenhouse walls are built of hollow bricks, 10 inches wide, with a septum through the middle.

The main greenhouses are each 20 feet wide by 100 feet long. They are separated by hollow-brick walls, in order to facilitate experiments in heating.

FARMERS' INSTITUTES.

Through the courtesy of Mr. L. N. Bonham, secretary of the State Board of Agriculture, the members of the station staff have had the privilege of meeting many of the best farmers of the State in their institutes. We feel that such intercourse promotes a better understanding by both farmers and station workers of the nature and difficulties of the problems, which demand the station's attention.

DAIRY TESTS.

In coöperation with the State Board of Agriculture the station has superintended the testing of several cows of different breeds during the year. The station stands ready to assist in any practicable manner in determining the relative value of the different breeds of cattle, and it is earnestly hoped that a way may soon open by which the great live stock and dairy interests of our State may receive attention proportionate to their importance.

PUBLICATIONS.

The publication of the station's bulletin has been seriously interfered with by the extra work incident to the removal, which has made it impossible to prepare for publication a large amount of material already in hand. This material will be prepared and published as rapidly as possible.

Our newspaper bulletin, published by coöperation with the CENTRAL PRESS ASSOCIATION of Columbus, has reached its 114th number, and members of the station staff have contributed frequently to the agricultural press during the year.

Following is summary of the contents of the ten numbers of the regular bulletin issued during the year:

BULLETIN No. 1, VOL V, JANUARY, 1892, BY J. FREMONT HICKMAN.

Field experiments with oats, including comparison of varieties, distribution of seed, methods of planting and treatment for smut.

SUMMARY.

Varieties: These experiments extended over two seasons, 1890 and 1891, and included fifty-four differently named lots in the variety tests. The season of 1890 was very unfavorable, all varieties suffering from a hitherto undescribed disease, which reduced the average yield by more than half. The largest yields were given by Improved American, Dakota Gray, white Canadian and State of North Dakota, these four varieties producing thirty-three bushels per acre and over. Monarch, Early Dakota, Black Tartarian and Wideawake stand next

The season of 1891 was favorable, and the largest yields were given by Prince Edward's Island, Black Tartarian, Dakota Gray, Black Prolific, Seizure, Giant Yellow French, Golden Giant, Rust Proof, Early Swedish, Japan and Improved American, all of these except Improved American and Rust Proof having a compact or one-sided panicle.

In a series of tests extending over six years, the varieties that have given the largest yields are Probsteier, Early Dakota, Black Tartarian, Monarch, State of North Dakota, Rust Proof, Kansas Hybrid, White Schoenen and Black Russian.

After two years' trial the Virginia Winter Oats is discarded as not adapted to our climate.

Seed per acre: In general, the more seed sown per acre in the abnormal season of 1890, the higher the product. In 1891, seeding at the rate of seven and eight pecks per acre produced a larger crop than either heavier or lighter seeding.

Depth of planting,—Drilling vs. broadcasting: In the two season's experiments larger crops of oats have followed planting from one to two inches deep than from deeper planting. A slight advantage is indicated for seeding with the drill as against broadcasting.

Treatment for smut: The "Jensen," or hot water treatment, (soaking the seed for a few minutes in water heated to about 135 degrees Fah.) for preventing smut has given good results, and is commended for further trial by farmers.

BULLETIN No. 2, VOL. V., FEBRUARY, 1892, BY J. FREMONT HICKMAN.

Field experiments with mangolds and sugar beets, including comparison of varieties, transplanting, continuous cropping with and without manures, disposal of leaves and suggestions for beginners in beet culture.

SUMMARY.

Varieties: In the Long Red class of mangolds the Giant Long Red has, in a series of years, seemed to have more vitality in the seed used, and has given a more satisfactory average growth than any other one of that class

The Giant Holstein, Dignity and Jumbo have all made occasional higher yields than the Giant Long Red, and are among the best sorts in that class.

The Giant Yellow Intermediate, Yellow Ovoid and Yellow Leviathan are among the better kinds in the Ovoid class.

The Globe class as a whole has been the least valuable type of mangolds.

According to the experiments detailed in this bulletin, an acre of sugar beets, properly grown, is decidedly more valuable for feeding stock than an acre of mangold wurzels.

The sugar beets grown at this Station during the past year have shown a percentage of sugar too small to justify growing them for sugar making purposes.

Transplanting: Transplanting mangolds has not been attended with satisfactory results, except in filling up rows to make a more perfect stand.

Cutting off the leaves when transplanting has not been any benefit.

Manuring: Manuring land with fresh barn yard manure has in every case decreased the yield of mangolds.

Continuous cropping with mangolds has resulted in reducing the ability of the land to produce this crop by at least 10 per cent. each year for the first three years.

Disposal of leaves: Preserving the leaves in the silo with corn ensilage has not been found practicable.

It has been found possible to preserve them in a well or cistern in the ground with but little loss, but they were not relished by the stock, even when well kept.

On account of the large proportion of fertilizing elements in the leaves, it is advisable to leave them upon the ground.

BULLETIN No. 3, VOL. V, MARCH, 1892, BY C. E THORNE AND J. FREMONT HICKMAN.

Field experiments with commercial fertilizers, including experiments on corn and oats grown continuously, coöperative experiments on corn by farmers, and experiments on crops grown in rotation.

SUMMARY.

Fertilizers on corn: In the experiments with fertilizers on corn, superphosphate and potash, used separately or in combination, have as often caused loss as gain in the crop, unless nitrogen was also added.

In those cases where superphosphate seemed to have a favorable influence independent of nitrogen, gypsum also proved beneficial, indicating that a part of the effect of the superphosphate was due to the gypsum contained.

Nitrate of soda has generally increased the crop when used alone, and when used in combination with superphosphate and potash, one or both, it has caused an increase in practically every case.

Cost of fertilizers and value of increase: While there have been cases in which the increase of crop apparently due to the fertilizer has been sufficient to pay the cost of the fertilizer, it has been impossible to repeat this result on duplicate plots through successive seasons, thus indicating that in such cases the increase was largely due to accidental variations in the soil.

Fertilizers on oats: In the experiments on oats the fertilizers have apparently produced an increase of crop in practically every case, the increase being more uniform when the fertilizer contained nitrogen; but at present prices of grain and fertilizers respectively, the average increase has in no case been sufficient to pay the cost of the fertilizer.

Fertilizers on crops grown in rotation: The experiments on crops grown in rotation have not yet been carried over a sufficient length of time to justify general

conclusions; but thus far they offer no more encouragement to the use of chemical manures than those on crops grown continuously.

Value of stable and yard manures: A very wide difference is indicated in the value of stable manure according as it is used fresh from the stable or after half a year's leaching in the barnyard. Apparently the margin of profit in the use of open yard manure is extremely meager.

BULLETIN NO. 4, VOL. V, APRIL, 1892, BY F. M. WEBSTER.

Insects which burrow in the stem of wheat, an illustrated description of eight species of insects having this habit.

SUMMARY.

The Joint Worm, *Wheat Straw Worm*, and *Wheat Stem Saw-fly* all belong to the same order of insects as the ant, bee and wasp. The eggs are deposited in the growing stems, and the insect passes the fall and winter in the stubble.

Burning the stubble will probably destroy the majority of the insects in the field, while a rotation of crops will do much to prevent their becoming abundant,

The Grain Sphenophorus destroys wheat by burrowing in the basal joints of the straw This is one of quite a number of species which do serious injury to corn, being known as corn Bill-bugs.

The Stalk-borer is a near relative of the cut-worm and army worm, but departs from the habits of these last by burrowing in the stems of wheat and other grains. Little damage is done to wheat, its chief injury being among corn and vegetables.

The Wheat Stem Maggot is the young of a small fly which deposits its eggs on the leaves of growing wheat and grass in spring, summer and fall The maggots burrow in and destroy the tender, growing stems, and are particularly noticeable in wheat fields just before harvest, when they work just above the upper joint, causing the heads of the grain to wither and turn white. At other times they cause the center of the plant to turn yellow and die. Sowing plats of wheat in mid-summer, and plowing these under in September, will destroy many of the larvæ, as will also the destruction of volunteer wheat. Some varieties of wheat are attacked more severely than others.

The Companion Wheat-fly and the *American Frit-fly* are small dark colored flies resembling minute house flies. The habits of their larvæ are much the same as those of the wheat stem maggot, and similar remedies and preventives will probably be found equally effective.

BULLETIN 42 (VOL. V, NO. 5) AUGUST, 1892, BY J. FREMONT HICKMAN.

Field experiments with wheat, including methods of seeding, wheat after melilotus, shrinkage in the granary, degeneration of varieties, comparative test of varieties, "scab" and smut.

SUMMARY.

Methods of seeding. Previous experiments at this Station have not shown wide variations in yield between wheat drilled and sown broadcast; this year's experiment indicates clearly that of the two methods, drilling is decidedly the better.

Cross drilling has apparently been of some advantage this year, although the results of a similar experiment made a year ago, do not agree with those of this season.

Mixing two varieties and drilling them together has been of no advantage, last year or this.

Wheat after melilotus. A single experiment indicates that sterile clays may sometimes be rendered comparatively productive at slight expense by the growth of melilotus, or Bokhara clover.

Shrinkage in the granary. Wheat threshed from the shock, but in dry condition, lost a little over two per cent in weight in three years. In a wet season wheat increased slightly in weight from January to July.

Degeneration of varieties. Varieties grown twelve years in succession, without change of seed, show no evidence of deterioration. Selected seed has given a better quality of grain in the crop, but no marked increase in yield as yet.

Varieties. Judging from the experience of this and former years, we recommend the following sorts of wheat as probably the safest for general culture throughout Ohio: Valley, Fultz, Velvet Chaff (Penquite,s), Egyptian and Nigger. Diehl-Mediterranean, under its various names, has given good yields on this farm and in favored localities, but can not be recommended for general culture, and the same may be said of Martin's Amber, and its synonyms Landreth and Silver Chaff. Rudy, Deitz, Poole, Currell's Prolific, Early Red Clawson, Hicks and Jones' Winter Fife are worthy of further trial.

Smut and scab. Stinking smut was present in almost every variety of wheat grown, but not sufficient in any one to do material injury to the crop of this year.

Loose smut damaged the Hicks (and its synonym, Hickman) wheat at least eight per cent; other varieties very little.

The scab damaged later varieties of wheat most, and did greater injury to the earlier ripening wheats where the ground was poorly prepared or imperfectly drained, causing them to ripen later than they would under favorable conditions.

BULLETIN 43 (VOL. V, No. 6) SEPTEMBER, 1892, BY W. J. GREEN, E. C. GREEN, W. S. TURNER, E. V. WILCOX AND F. M. WEBSTER.

Greenhouses and greenhouse work, by W. J. Green, E. C. Green and W. S. Turner, including methods of piping, fertilizers in the greenhouse, sub-irrigation in the greenhouse, the water bench, crops suitable for forcing, calendar of operations, lettuce and tomatoes as greenhouse crops.

SUMMARY.

Fertilizers in the greenhouse. A rich compost was used, as is customary in such work, and the problem proposed was to determine whether nitrate of soda and other nitrogenous fertilizers could be used with profit on crops grown in such soils. No chemical fertilizer, either singly or in combination, was found to be of any value for lettuce, radishes, cucumbers and tomatoes. On poorer soils the case might be quite different, but a compost composed largely of manure is a necessity in the greenhouse, and such a compost usually contains a sufficient supply of plant food, and in a cheaper form than can be found in chemical fertilizers.

Sub-irrigation in the greenhouse. Beds were so constructed as to admit of watering by means of sub-irrigation, through drain tiles laid two and one-half feet apart. All the water required by the plants was supplied in this manner, and none was applied to the foliage. The result on lettuce was very marked, the gain of sub-irrigated over surfaced-watered plants being about fifty per cent. Sub-irrigated radishes came to maturity several days earlier than those watered in the ordinary manner. Cucumbers were greatly benefited by sub-irrigation, but tomatoes thus treated showed only a small gain over those watered in the ordinary manner.

The water bench. This is a water-tight bench, and is used for the purpose of watering plants which are grown in flats or trays, holding about two inches of

soil, and having slatted bottoms. A small quantity of water is poured into the water bench and the trays are set in the water for a short time. This is simply an extension of sub-irrigation. and is the best method of watering seed just after sowing and all kinds of small plants in flats. Recent results indicate that a crop of lettuce can be brought to maturity from one to two weeks earlier by this plan than by the ordinary method.

Crops suitable for forcing. Almost any crop can be grown in the greenhouse, but lettuce, mushrooms, radishes and tomatoes pay best. Cucumbers, beans, dandelion, cauliflower and pie-plant may be grown with some profit.

Tomatoes as a spring and summer crop. It has been found to be more profitable here, to grow tomatoes in the greenhouse after the lettuce season is past, than to occupy the house with them during the winter. The seed is sown about the middle of December, and the plants are twice transplanted before they are set into permanent beds for fruiting. About the middle of March the plants are set in the beds about two feet apart each way. The plants are trained to a single stem, and tied to stakes or some other support. Acme, Beauty, Perfection and Dwarf Champion are suitable varieties for the purpose.

Lettuce as a geenhouse crop. The first sowing should be made in September, and others should follow at intervals of three or four weeks thereafter, until about the last of January. Seed is sown in flats and when large enough the plants are transplanted into flats, 2 x 2 inches apart, where they remain three or four weeks, when they are again transplanted, but into beds, 6 x 8 inches apart. About twelve weeks from the date of sowing is the time required for a crop to come to maturity, but only about half of this period are the beds fully occupied, hence several successive crops can be brought forward at the same time.

About thirty cents per square foot of greenhouse space is a fair estimate for the returns from the lettuce crop during the season, which does not include other crops that may be grown at the same time under the benches. Grand Rapids is the most profitable variety to grow, except in localities where the market demands the heading varieties.

Bulletin 43 also includes a paper on *The Food of the Robin*, by E. V. Wilcox, W. J. Green and F. M. Webster, being a summary of the examination of the stomachs of 74 robins, taken at different times during the season, from which it appears that in general the robin subsists upon the food which is most easily obtained. During the time when berries are plentiful the robin eats but little else; at other times he takes insects and seeds of various kinds. The amount of fruit taken is often a serious tax upon the small small fruit grower, and many of the insects destroyed by the robin are beneficial.

On the other hand, he takes some injurious insects, and many that are not known to be either beneficial or injurious, hence it is not easy to determine just how much blame or credit should be given the robin. To many fruit growers he possibly does more harm than good, but to the general public the reverse is no doubt true, hence it appears that the tribute which the robin exacts is borne by a few and justice requires that those, who would protect their crops from his depredations, should be allowed to do so, without fear of arrest. There does not appear to be any cause, however, for any general effort to exterminate the robin.

BULLETIN 44 (VOL. V, NO. 7) SEPTEMBER, 1892, BY FREDA DETMERS, C. E. THORNE AND A. D. SELBY.

A preliminary list of the rusts of Ohio, by Freda Detmers. An enumeration of species of Uredinæ observed in the state.

Wild lettuce—a pestiferous weed, by C. E. Thorne, A. D. Selby and Freda Detmers. An account of rapid spread of this weed over the Station farm, with illustrated description.

Scab of Wheat, by Freda Detmers. A technical description of this fungus, illustrated.

BULLETIN 45 (Vol. V, No. 8) DECEMBER, 1892, BY F M WEBSTER.

Insects Affecting the Blackberry and Raspberry.

SUMMARY.

The Bulletin considers all species of insects known to the author as in any manner affecting plants of the genus Rubus, but especially the Blackberry and Raspberry. All species are included without respect to the injury they do to these plants, for the reason that the fruit grower is often at a loss to distinguish those that are almost sure to ravage his crop, from those that are little likely to do so. Besides, many species that work little injury to these fruits are veritable pests on some others. Therefore, all are treated quite fully, and separated by numbers into divisions according to the amount of damage they are likely to do. There is also another separation, by numbers, whereby each species falls under the remedial measure or measures most likely to afford relief.

BULLETIN 46 (Vol V, No 9) DECEMBER, 1892, BY F M WEBSTER.

Underground Insect destroyers of the Wheat plant.

SUMMARY.

Wire worms are the larvæ or grubs of snapping or click beetles, and breed especially in low, damp, cold soils, feeding on the roots of grass and, probably, other herbaceous plants. They probably require a little over three years to develop from egg to the adult. No thoroughly practical method of destroying the worms has yet been discovered. Their numbers may be reduced by fall plowing, and their haunts rendered unattractive by a rapid rotation of crop and by underdrainage. Where fields of corn are attacked and replanting made necessary, it is best to plant the second time between the old rows, allowing the latter to stand as long as possible in order to hold the attention of the worms and keep them diverted from the latter plants.

White Grubs are the offspring of the May beetles or June bugs. While the wire worms develop to adults in summer and live over winter in that stage, the white grubs pass the winter either as grubs or pupæ and develop to adults in spring, otherwise the life history of the two are much the same. The eggs are laid in the ground, notably in grass lands, and hatch in about 30 days. The young work little injury the first year, but the next they ravage the fields most seriously. These prefer the higher to the lower lands and therefore drainage has much less effect upon them. Probably fall plowing and rapid rotation of crop are the two best methods to pursue. Fertilizing with barnyard manure is a protection against damage in infested fields

Crane flies are known also as Gallinippers, and many term them cut-worm flies, though they have no connection with cut-worms There are a number of species of these, some of which are one and others two brooded each year. The eggs are deposited in grass and clover land, more particularly in low, flat, damp lands. The maggots feed on the roots, seldom appearing above ground except in very wet weather The ravages of these larvæ can be prevented among wheat lands by plowing these early in September. This measure will also preclude the probability of injury to corn the following year. For injuries in grass or clover lands no remedy or preventive is as yet known.

ACKNOWLEDGMENTS.

The publishers of the following journals have aided the Station in its work during the year, either by republishing abstracts from its bulletins or by donating their publications to its libra y:

AGRICULTURAL PAPERS OF OHIO.

American Grange Bulletin, Cincinnati.
Farm and Fireside, Springfield
Farmer's Home, Dayton.
Gleanings in Bee Culture, Medina.
Ohio Farmer, Cleveland.
Stuart's Agriculturist and Stock Breeder, Cleveland.

GENERAL PAPERS OF OHIO.

Arcanum Enterprise, Arcanum.
Attica Journal, Attica.
Auglaize County Democrat, Wapakoneta.
Bakersville Press, Bakersville.
Barnesville Republican, Barnesville
Cincinnati Price Current, Cincinnati.
Cincinnati Weekly Commercial Gazette, Cincinnati.
Columbus Record, Columbus.
Cortland Herald, Cortland.
Crestline Advocate, Crestline.
De Graff Buckeye, De Graff.
Democratic Herald, Delaware.
Democratic Record, Chardon
Fredericktown Free Press, Fredericktown.
Fremont Journal, Fremont
Geauga County Record, Chardon.
Geauga Leader, Burton.
Greenville Democrat, Greenville.
Herald, Middleport.
Industrial News, Toledo.
Jacksonian, Wooster
Kenton Graphic News, Kenton.
Leader, Chillicothe.
Lewisburg Reporter, Lewisburg.
Lodi Review, Lodi.
Malta Register, Malta.
Monroe Journal, (German), Woodsfield.
Northern Ohio Journal, Painesville.
Ohio State Journal, Columbus.
Painesville Telegram, Painesville.
Plain City Dealer, Plain City.
Press, Columbus.
Republican Leader, New Lisbon.
Shelby News, Shelby
Tuscarawas Advocate, New Philadelphia
Tuscarawas Chronicle, Uhrichsville and Dennison.
Union County Journal, Marysville.

Valley Enterprise, Milford.
Wayne County Democrat, Wooster.
Wayne County Herald, Wooster.
West Liberty Banner, West Liberty.
Wood County Democrat, Bowling Green.
Wooster Journal, Wooster.
Wooster Republican, Wooster.

MISCELLANEOUS PAPERS.

Agricultural.

Acker und Gaitenbau Zeitung, Milwaukee, Wis.
Agricultural Epitomist, Indianapolis, Ind.
Agricultural Journal, Montgomery, Ala.
Agricultural Science, State College, Pa.
Agricultural Gazette, New South Wales.
American Agriculturist, New York, N. Y.
American Gardening, New York, N. Y.
American Homestead, Omaha, Neb.
American Rural Home, Rochester, N. Y.
Breeder's Gazette, Chicago, Ill.
California Cultivator and Poultry Keeper, Los Angeles, Cal.
Canadian Entomologist, London, Ont., Canada.
Colman's Rural World, St. Louis, Mo.
Dairy Messenger, Chicago, Ill.
Dakota Farmer, Huron, South Dakota.
Farm and Home, Chicago, Ill., and Springfield, Mass.
Farmers' Advocate, London and Winnipeg, Canada.
Farmers' Voice, Chicago, Ill.
Farm, Field and Fireside, Chicago, Ill.
Farm Implement News, Chicago, Ill.
Farm, Stock and Home, Minneapolis, Minn.
Florida Agriculturist, De Land, Fla.
Fruit-Growers' Journal, Cobden, Ill.
Grange Visitor, Lansing, Mich.
Holstein Friesian Register, Boston, Mass.
Home and Farm, Louisville, Ky.
Husbandman, Binghamton, N. Y.
Industrial American, Lexington, Ky.
Indiana Farmer, Indianapolis, Ind.
Journal of Agriculture, St. Louis, Mo.
Maritime Agriculturist, St. John, N. B.
May Flower, Floral Park, N. Y.
Mirror and Farmer, Manchester, N. H.
National Stockman and Farmer, Pittsburgh, Pa.
New Dairy, New York, N. Y.
Orange Judd Farmer, Chicago, Ill.
Pacific Rural Press, San Francisco, Cal.
Practical Farmer, Philadelphia, Pa.
Prairie Farmer, Chicago, Ill.
Rural New Yorker, New York, N. Y.
Rural Northwest, Portland, Oregon.
Southern Cultivator and Dixie Farmer, Atlanta, Ga.
Southern Planter, Richmond, Va.

Sugar Beet, Philadelphia, Pa.
Weekly Globe and Canadian Farmer, Toronto Canada.
Western Breeder, St. Joseph, Mo.
Western Farmer and Stockman, Sioux City, Iowa
Western Resources, Lincoln, Neb.
Western Stockman and Cultivator, Omaha, Neb.
Western Swineherd, Geneseo, Ill.
Wisconsin Farmer, Madison, Wis.

General.

Baltimore Weekly Sun, Baltimore, Md.
Boston Globe, Weekly, Boston, Mass.
Detroit Free Press, Weekly, Detroit, Mich.
Engineering and Mining Journal, New York, N. Y.
National Provisioner, New York, N. Y.
Pharmaceutical Era, Detroit, Mich.
Press, The Weekly, New York, N. Y.
Press, The Weekly, Philadelphia, Pa.
Science, New York, N. Y.
Union, The Weekly, Manchester, N H.
World, The Weekly, New York, N. Y.

IMPLEMENTS, SEEDS AND PLANTS RECEIVED.

Thanks are returned for the following donations to the Station:

AGRICULTURAL DEPARTMENT.

J. E. Hedges, Ashville, O, one set of listers.
Deere & Co., Moline, Ill., spring tooth cultivator.
Bucher & Gibbs Plow Co., Canton, O., tubular roller.
Currie Bros., Milwaukee, Wis., one-fourth pound rape seed.
F. Barteldes & Co., Lawrence, Kansas, one pound Kaffir corn.
F. Barteldes & Co., Lawrence, Kansas, one pound Jerusalem corn.

HORTICULTURAL DEPARTMENT

Barteldes & Co., Denver, Colo., several varieties of seeds.
L. K. Ballard, Warren, Ill., raspberry plants.
S. Buffington, Kesler, O, strawberry plants
C. P. Bauer, Judsonia, Ark., strawberry plants
Wm. Belt, Williamsburg, O, strawberry plants
Isaac Clawson, Osage, Iowa, strawberry plants
R. S. Cole, Harmans, Md, strawberry plants.
C. S. Curtice, Portland, N. Y., Early Ohio grape vine.
T. J. Dyer, Cornwall, N. Y, strawberry plants.
U. S. Department of Agriculture, seeds, cuttings scions and plants.
R. S. Edwards, Highlands, Colo., strawberry and raspberry plants.
Frank Ford & Son, Ravenna, O., potato.
Boswell Fox, Manchester, Ky, strawberry plants
D. M. Ferry & Co., Detroit, Mich., beans.
Geo. S. Josselyn, Fredonia, N. Y., red jacket gooseberry, Esther and Rockwood grapes.
S. F. Leonard, Chicago, Ill., seeds.
Frank Murphy, Donnellsville, O., raspberry plants.

A. C. Maxwell, Lawrence, Kansas, blackberry plants.
Wm. Mendenhall, Marion, Ind., strawberry plants.
McMath Bros., Onley, Va., strawberry plants.
Chas. E. Pennock, Bellevue, Colo., cherry trees.
C. S. Pratt, Reading, Mass., strawberry plants.
Lewis Roesch, Fredonia, N. Y., gooseberry plants.
T. L. Ray, East Chardon, O., strawberry plants.
Slaymaker & Son, Dover, Del., strawberry plants.
Frank H. Smeltzer, Van Buren, Ark., strawberry plants.
The Storrs & Harrison Co., Painesville, O., currant plants.
J. F Thompson, Oneida, O., raspberry plants.
H. G. Wolfgang, strawberry plants.
A M. Nichols, Granville, O., tomato seed.
Wm. Stahl, Quincy, Ill., spraying nozzle.

The purpose of the listers above mention is to regulate the depth of planting corn. The implement can be attached to any planter, and does its work to our entire satisfaction.

The spring tooth cultivator is designed for shallow cultivation, and, after a season's trial, we heartily recommend it for such work.

We consider the tubular roller superior to any smooth roller for pulverizing the soil. We find it a well made and durable implement.

The seeds and plants will be reported upon in future bulletins.

In conclusion, I have again the pleasure of reporting a year of harmonious and earnest effort on the part of all connected with the station. The Board of Control has acted as a unit at all times, and both the members of the board and my co-workers of the station staff have cheerfully submitted to serious personal inconvenience in order to advance the station's work.

Respectfully submitted,

CHAS. E. THORNE, *Director.*

REPORT OF THE AGRICULTURIST.

In consequence of the Station taking possession of the farm in Wayne county early in April, 1892, and in anticipation of the removal of the entire station during the year, the work of this department was in some respects necessarily curtailed, while in others the possession of both farms during the greater part of the growing season has been of some advantage. The experiments in the field have constituted as usual the larger share of the work done. The following is a brief summary of the plans that have been carried out in detail:

Wheat: A series of cultural experiments, the plan and results of which have been published in Bulletin No. 5 of this volume, a summary of which is given in the report of the director. Also, a series of experiments in the application of commercial and other fertilizers to wheat, the results of which will appear in a future bulletin.

Oats: (1.) A variety test of forty-four differently named sorts was conducted on the farm in Wayne county.

(2.) A comparison of yields from the use of different fertilizers was continued on the farm hitherto occupied by the Station in Franklin county.

The variety test conducted in Wayne county was rather unsatisfactory, owing to irregular and imperfect drainage.

Corn: (1) (*a*) Thirty-four varieties of dent corn were grown in a comparative test, both on the farm at Columbus and upon the station farm near Wooster. (*b*) Twelve varieties of ensilage corn were grown in a comparative test at Columbus. (*c*) Eight or nine varieties highly recommended by seedsmen were sent out to farmers over the State to ascertain if they would mature upon Ohio soils.

(2.) Experiments were continued on the farm at Columbus, in methods of planting and culture, including, (*a*) contrasting deep and shallow tillage; (*b*) testing vitality of seed by planting continuously seed from the same parts of the ear; (*c*) detasseling every other row; (*d*) pulling suckers off *vs.* leaving them on. Experiments with chemical and other fertilizers were conducted upon both the station farm at Wooster and the farm at Columbus, as well as in several other counties of the State.

In addition to the above experiments with commercial manures upon wheat, oats and corn, a block consisting of thirty-five one-twentieth acre plots has been devoted to a system of rotation in the order of corn, oats, wheat and clover and timothy two years. This gives the commercial fertilizers an opportunity to show their effect upon the grass crops.

Mangel wurzels and sugar beets · About three and one-half acres of land was devoted to root crops, including, (*a*) comparative test of varieties of mangel wurzels; (*b*) comparative test of varieties of sugar beets; (*c*) continuation of experiment on soil exhaustion; (*d*) planting of sugar beets in rows at varying distances, to determine the possibilities of an acre in sugar production and the comparative cost of production under the different conditions of planting. Seeds were sent to a few farmers in the State to grow samples upon different soils, with a view of ascertaining whether the soils of the State are adapted to sugar beet growing or not.

The experiments with oats, corn and beets will be reported in future bulletins.

Alfalfa: During the growing season a third unsuccessful attempt was made on the farm at Columbus to get a set of alfalfa by seeding the ground with oats and alfalfa together.

Japan Clover—Lespedeza striata: Japan clover seed was sown in the growing corn in Wayne county, in the month of July. Some of it grew, but not enough to make a fair stand.

Indian mallow: One-fourth acre of Indian mallow (*Abutilon avicennæ*) was successfully grown for the use of the Agricultural Department at Washington.

Dairy: During the first four months of the year considerable time was devoted to the duplication of the feeding experiment conducted the two winters preceding. The plan of the experiment was extended in some directions to bring out some points more prominently. Sixteen cows were included in this trial, one-half of which were grade cows and the other half registered Jerseys The results will be published in a future bulletin.

The State dairy test conducted by the State Board of Agriculture in coöperation with this station has occupied a small portion of my time. It has been my duty to witness the milking at the home of each cow tested, to take the sample for analysis, and deliver the same to the Station analyst.

During the year I have attended and taken part in twenty-one farmers' institutes, where I have endeavored to place before the farmers of the State the more valuable object lessons brought out by experiments on the Station farm. I have given considerable time to laying out and platting parts of the farm near Wooster. In all the work of the year I desire to acknowledge the valuable assistance and hearty coöperation of Mr. William Holmes and Mr. C. A. Patton. Both have been conscientious and interested workers.

J. FREMONT HICKMAN, *Agriculturist.*

REPORT OF THE HORTICULTURIST.

The work of the horticultural department during the year may be classified as follows:

I. Experiments with fruits.
II. Experiments in vegetable culture under glass.
III. Experiments in vegetable culture out of doors.
IV. Experiments with insecticides and fungicides.

The season was favorable for small fruits, especially for strawberries. A detailed report of the varieties tested will be given in a future bulletin, of which the following is a summary:

Strawberries.—(1.) Considerable advance has been made within the last five years in the origination of prolific perfect flowered varieties, to serve as pollenizers. The best of this class are, Lovett, Muskingum, Enhance, Parker Earle and Beder Wood.

(2.) The best of the newer imperfect flowered varieties are, Greenville, Barton's Eclipse and Shuster.

(3.) Those most suitable for home use, because of high quality, are Brunette and Farnsworth.

(4.) Because of firmness, Van Deman and Stayman may prove valuable for long shipment, but are deficient in size.

(5.) The following have not proved satisfactory here: Dayton, Michel's Early, Oregon Everbearing, Gen. Putnam.

(6.) Saunders, Gov. Hoard, Martha and Huntsman have good qualities, but no very marked characteristics, and are not likely to become general favorites.

(7.) The most reliable of the old varieties are, Haverland, Crescent Bubach and Warfield.

Raspberries.—(1.) The most promising red raspberries of recent introduction are, Royal Church, a large late sort of excellent quality, and the Thompson, a very early variety of medium size.

(2.) The Eureka, also called Mohler, is a promising blackcap, equal in size to the Gregg and nearly as early as Palmer. Kansas is similar to the Eureka, but several days later. The above appear to be acquisitions of great value, and will be more fully described in a future bulletin.

(3.) Palmer, Hilborn, Ohio, Gregg, Turner, Cuthbert, Shaffer and Muskingum still retain their place among the well tested standard sorts.

Blackberries.—The Eldorado is the most promising of the newer hardy blackberries. It appears to be as hardy as Snyder and is rather larger and of better quality. Snyder, Ancient Briton and Eldorado are

the only perfectly hardy sorts in central Ohio. Erie and Minnewaski are larger than any of the above but less hardy, and are suited only to sections where the climate is comparatively mild.

Gooseberries.—The most promising of the newly introduced gooseberries are, Portage, Puyallup Mammoth and Pearl. The first and second attain size of nearly an inch in diameter, and are much alike. Pearl is smaller, but is extremly productive and gives promise of being valuable for market. The Industry is not satisfactory in all localities, because of its tendency to mildew, but this is easily overcome by the use of fungicides. The Downing is the most valuable of the old varieties.

Strawberries, raspberries, blackberries and gooseberries are the only fruits to be treated in the forthcoming bulletin above mentioned.

Garden Vegetables —Considerable attention has been given to growing vegetables under glass. Two greenhouses, each 20 x 100 feet, heated by hot water, have been used for the purpose. The details of the results obtained thus far are given in Bulletin 43, September, 1892, of which a summary is given in the report of the Director.

Comparatively little work was done in out door vegetable culture, as most of the crops planted were for experiments in spraying, or in special methods of culture.

The most noteworthy of the latter was an experiment in pruning and training tomatoes, the results of which are not ready for final report, as another season is required in which to perfect the plan adopted. The plan consists simply in training the plants to a single stem and in tying to a trellis of an improved form. The plan is not new, except in some details, but the end sought was to determine to what extent pruning induces early ripening. The results indicate that from one to two weeks may be gained by this method, over the plan ordinarily practiced. The tomatoes are also larger and freer from rot.

The bed method of growing celery and onions by transplanting has been given attention, as well as the nomenclature of the varieties of these vegetables, and will be reported upon in due time.

Experiments with Insecticides and Fungicides.—For the purpose of corroboration, much of the work done in previous seasons was repeated, but new features were also introduced and new facts learned. The following is a summary of the results obtained:

(1.) The dilute Bordeaux mixture, which is composed of four pounds of sulphate of copper, four pounds of quicklime and fifty gallons of water, has again proved to be the best general purpose fungicide, also the best vehicle in which to use arsenical poisons for the destruction of foliage-eating insects. A too persistent and prolonged use of it must be avoided, however, as, if applied late, it may stick to the fruit until after it is ripe, and upon apples and pears it causes a russet appearance.

(2.) The copper arsenic solution, made by dissolving six ounces copper carbonate and four ounces of Paris green in two quarts of ammonia,

to which are added fifty gallons of lime water, is an excellent combined fungicide and insecticide, and is probably the best of any for pears.

(3) The early dropping of apples, which has been charged to wet weather at the time of blooming, was largly prevented the past season by early spraying with the Bordeaux mixture. A fair crop was secured from the sprayed trees, but none at all from the unsprayed.

(4) It has been fully demonstrated that premature leaf dropping of plum trees may be prevented by the use of the Bordeaux mixture, and that when Paris green or London purple is used for curculio, it is necessary to use the Bordeaux mixture as a vehicle for conveying the poison.

(5) Some results obtained last season indicate that Bordeaux mixture of two or three times the above strength is better for the first and second applications on grapes than the dilute mixture

(6.) The use of Paris green, either alone or in combination with Bordeaux mixture, has not been attended with success on peach trees and American varieties of plums, because of the harm done to the foliage.

(7.) Some preliminary experiments in spraying peas show that the mildew can easily be prevented, and the crop greatly benefitted by the treatment.

(8.) The potato scab was almost wholly prevented by soaking the seed before planting, one hour in dilute Bordeaux mixture. No benefit was derived from the treatment, however, when the potatoes were planted on soil where a potato crop had been grown the previous season.

(9.) The potato blight has usually been largely prevented by applications of Bordeaux mixture to the tops, but last season but little effect was produced by the treatment, owing perhaps to the fact that the blight was less severe than usual.

A future bulletin will treat of various topics connected with spraying. It will give not only the results of recent experiments, but also directions for the treatment of some of the most common fungous diseases, and the best methods of combating insects and diseases in common.

W. J. GREEN,
Horticulturist.

REPORT OF THE ENTOMOLOGIST.

Up to July 1, 1892, the arrangement between the United States Department of Agriculture and the Experiment Station, as set forth in my preceding report, remained in force, after which date it was annulled by the Department, owing to a lack of funds. In March I was notified of the probability of a two month's furlough without pay, and although this was withdrawn later, it was followed by instructions to hold myself in readiness to spend some time on the Pacific coast. In view of these uncertainties, some investigations requiring continuous personal attention, and which would have been rendered valueless by my absence, were not undertaken. The removal, in June, from Columbus to the new location of the Station at Wooster, and the necessary delay in securing proper quarters for my laboratory work, still further interrupted many investigations, and, in fact, some were temporarily abandoned.

During the months of February and March, considerable time was spent in experimenting with insect and fungous parasites of greenhouse pests, with a view of turning them to practical use. Of the Hymenopterous parasites reared, one was *Encyrtus flavus* Howard, a parasitic of that universal pest of the conservatory, the Soft Brown Scale, *Lecanium hesperidum*. This parasite had not heretofore been observed except in California. It proved very efficient in destroying this scale, which was, at the time, destructively abundant on roses. Another parasite species, *Aphelinus mali*, was reared, the female of which was described in 1851, but the male remained unknown until I reared both sexes from *Myzus mahaleb*. The most useful parasite on Aphids was *Aphidius phorodontis* Ashm., though it exercised little or no influence in holding in check other species like *Siphonophora avenæ*, and a large green species affecting lettuce. A totally unexpected enemy of the *Myzus* was found in the much abused slug, *Limax campestris* Binney. These slugs not only left the succulent, growing lettuce, of which they are known to be very fond, but climbed up wheat and other plants to the height of ten inches and fed upon the Aphids thickly clustered on the leaves. In all of these parasites, and also in the *Empusa aphidis*, we did not find a reliable check on the Aphides. It must be stated, however, that the temperature was not under my control, and the heating was not properly attended to, causing those frequent and radical changes in temperature so adverse to the development of parasites, while offering little if any obstacle to the increase of the Aphides. Later, and in the fields, a Syrphus fly, *Paragus tibialis*, was found parasitic on *Aphis rumicis* An aphis of the squash,

Siphonophora cucurbitæ, was carried through its entire cycle on *Capsella bursa pastoris* and *Nepeta glechoma*, males, oviparus and viviparus females and eggs being secured. This matter was published in the Canadian Entomologist, vol. XXIV, p. 311.

Considerable time was spent in the study of wheat insects. An outbreak of a species of wire worm, *Melanotus communis*, which destroyed about ten per cent. of the plants over a portion of one field, was investigated and the results published in Bulletin No. 46. The larvæ of a species of Saw Fly, probably *Dolerus arvensis*, as the adults were observed ovipositing in the field in early spring, were observed in considerable abundance in some of the Station fields. Three insect enemies of growing wheat, new, so far as any published record is concerned, were reared from the plants. These are all small flies much resembling *Oscinis variabilis* (?), an illustrated notice of which appeared in the bulletin of this Station for April, 1892, p. 81. Two of the new ones are Frit flies and are *Oscinis umbrosa* and *O. coxendix*, the latter of which was described by Dr. Fitch as occurring about wheat fields, but nothing has up to this time been learned of its habits. In this case these were, both of them, reared from the injured wheat plants. Their injuries closely resemble those of *Oscinis variabilis* (?). The third species is similar to these but undetermined. A new parasite on the last named species was reared and will be described in a bulletin of the technical series, now nearly ready for the printer. Two other rearings were of special interest from both an economical and technical standpoint. These were both species of *Diplosis*, probably undescribed, and very closely allied to the Wheat Midge, *Diplosis tritici*, but are, in this case, friends instead of enemies. The larvæ of one were engaged in destroying the cherry Aphis, *Myzus cerasi*, in Fulton county, and the other was engaged in destroying the cabbage Aphis *A. brassicæ*, at Columbus, Ohio. Instances of the carniverous habits of members of this genus, though not unknown, are not of common occurrence.

An injury to growing wheat in June, about Wooster, has been investigated. This consists of an attack by the old and long known joint worm, *Isosoma hordei*, though this is supposed to form galls or swellings usually below the upper joint of the straw, while in this case they were invariably situated above it. An entirely new species and for which it has become necessary to erect a new genus of Hymenoptera, was reared from these galls in considerable numbers, and it is likely that the species will prove to be a very useful parasite. This also will be described in the forthcoming technical bulletin.

A large number of other investigations have been carried on and the results have either been recorded in the regular bulletins, or else they have not yet sufficiently developed to demand mention here.

Of the outbreaks of injurious insects over the state there are a number which may be especially mentioned. The appearance of the

clover leaf Weevil, *Phytonomus punctatus*, in the Western Reserve and also in small numbers in the vicinity of Cincinnati, may be noted as the first occurrence of the pest in Ohio. The western corn root worm, *Diabrotica longicornis*, was also reported in destructive numbers in Hamilton county. This is, so far as I am aware, the first appearance of this pest in Ohio, and I would call attention to the probability of its slowly working its way eastward. A curious outbreak of a species of horse and cattle fly, *Tabanus abdominalis*, in Hamilton county was reported by Mr. R. H. Warder, of the Board of Control of this Station. These flies made their appearance in Mr Warder's neighborhood in August, in enormous numbers, and attacked stock, following cattle and horses like a swarm of bumble bees, as Mr. Warder expresses it, and biting the cattle until they became fairly raw on the neck from the attacks and their attempts to rid themselves of their tormentors. The scourge continued about two weeks

In conclusion, I wish to call attention to the necessity of placing a certain fund at the disposal of the Entomologist to cover traveling expenses and cost of field experiments, at a distance from the Station. This will enable him to promptly visit the locality of an outbreak of any insect and to aid and assist in the application of means of repression or prevention. No reputable physician will consent to treat his patients by mail, yet the Entomologist is compelled to do a precisely similar thing, and, it is expected, that his advice will be of such a nature as to enable people to stop or prevent the ravages of insect pests in orchard and field. This is simply an impossibility in many cases Some insects can be handled under instructions transmitted by mail, but there are many of which there is much to be learned in the matter of habits and remedial measures, and with a reasonable expense fund at his disposal the Entomologist would be in a position to save the people dollars where now he saves them dimes.

Without wishing to be egotistical in the least, the present incumbent of this office can furnish published proof that the expenditure of a few dollars and a few days' time resulted in the saving of $10,000 in a single year and that too, to a single, very extensive farmer of an adjoining state, the amount being estimated by the farmer himself.

F. M. WEBSTER,
Entomologist.

REPORT OF THE BOTANIST.

Having resigned my position at the Station before the close of the summer season, and being occupied during the latter part of that season in closing up the work, arranging the herbarium, preparing material for the Columbian Exhibition, etc., there was not much time for original investigation.

However, the lines of work laid down the previous year were followed as far as possible; various fungous diseases, especially apple scab and the diseases affecting the raspberry and blackberry, were carefully watched, but no additional reports were made. A brief report was published on *Septoria consimilis*, the leaf-spot disease of lettuce. Until last spring this disease was not noticed on cultivated lettuce in the Station gardens. The source of infection can be directly traced to the prickly lettuce, *Lactuca scariola*, as the fungus was very abundant on this very abundant weed. It is an interesting point, that in looking over the available station bulletins of all the states, I have found no report of this fungus on the cultivated lettuce.

Specimens of *Septoria consimilis*, *Cercospora apii*, *Cercospora beticola* and *Bremia lactucæ* were furnished for the Columbian Exhibition.

A preliminary list of the rusts of Ohio has been published, and, an article on *Empusa aphidis* will appear in a future bulletin.

FREDA DETMERS, *Botanist*

REPORT OF THE CHEMIST.

The work of this department has been confined mainly to the analysis of milk and feeding stuffs in connection with the feeding experiment conducted by the Station during the winter of 1891–1892. This work is not yet ready for publication.

Analyses were made of sugar beets, published in Bulletin No. 2, p. 23. Determinations of crude protein in wheat were made in connection with the field experiments with fertilizers on wheat, and were published in Bulletin No. 5, pp. 90–91.

Eleven analyses of milk were made during the year for the Ohio State Board of Agriculture in connection with the premiums offered by that Board, to be given at the Ohio State Fair.

Complete analyses of sixteen samples of soil were made from the field hitherto used in experiments with fertilizers on wheat, the results of which will be published later.

Some work was done determining phosphoric acid in fertilizers for the Association of Official Agricultural Chemists.

The following determinations of sugar in sugar beets were made for parties residing in various sections of the state, the object being to ascertain whether the culture of beets for sugar can be made profitable in Ohio. Thus far, only those raised in the northern part of the state have shown a sufficient percentage of sugar to justify their culture for this purpose.

DETERMINATION OF SUGAR IN BEETS RAISED IN OHIO.

Variety.	Date of planting.	Date of harvesting.	Sugar in beet—per cent.	Grown by	Post-office address.	County.
White Sugar Beet	July 2	Oct. 15	7.40	Esther Martz	Greenville	Darke.
Lane's Imperial	July 2	Oct. 15	6.46	"	"	"
Vilmorin's Improved	July 2	Oct. 15	9.46	"	"	"
Klein Wanzleben	April 27	Oct. 14	12.65	Exper. Station	Columbus	Franklin.
Wohauka	April 27	Oct. 14	9.06	"	"	"
Yellow Oberndorf	April 27	Oct. 14.	8.75	"	"	"
Red-top Sugar	June 24	Oct. 1	8.66	J. J. Reames	West Middl[illegible]	Logan.
Red-top Sugar	June 24	Oct. 1	7.83	"	" "	"
Red-top Sugar	June 24	Oct. 1	10.26	"	" "	"
Golden Giant	May 3	Oct. 20	5.01	Exper. Station	Wooster	Wayne.
White Sugar Silesian	May 3	Oct. 20	6.81	"	"	"
Breck's Imperial	May 3	Oct. 20	5.65	"	"	"
Golden Tankard	May 3	Oct. 20	6.17	"	"	"
Klein Wanzleben	June 1	Oct. 25	10.73	D. D. Benedict	Norwalk	Huron.
Klein Wanzleben	June 1	Oct. 25	12.40	"	"	"
Vilmorin	Early April	Last of Oct.	6.49	"	"	"
Vilmorin	May 12	Oct. 10	7.66	"	"	"
White Sugar	May 30	Oct. 10	8.47	Thos. A. Johnson	Rushylva[illegible]	Logan.
White Sugar	May 30	Oct. 10	7.86	"	"	"
Lane's Imperial	May 30	Oct. 10	12.54	"	"	"
Klein Wanzleben	May 9	Nov. 12	14.21	J. A. Nicholls	Norwalk	Huron.
Vilmorin	May 9	Nov. 12	13.58	"	"	"
Klein Wanzleben	June 3	Oct. 25	13.66	S. J. Rogers	"	"
Vilmorin	June 3	Oct. 25	14.03	"	"	"

Owing to the removal of the station it became necessary to equip a new laboratory in Wooster, which has involved considerable interruption to my work during the latter part of the year.

F. J. FALKENBACH,
Chemist.

APPENDIX.

BULLETIN

OF THE

OHIO AGRICULTURAL EXPERIMENT STATION.

VOL. V. SECOND SERIES. 1891.

CONTENTS.

BULLETIN

OF THE

OHIO AGRICULTURAL EXPERIMENT STATION.

VOL V, No 10
Whole Number 47 | SECOND SERIES | DECEMBER, 1892

METEOROLOGICAL SUMMARY FOR 1892

EXPLANATION OF TABLES

The following tables contain statistics of temperature, rainfall, etc., for the year, and are compiled from data obtained by daily observations, made at 7 a m , 2 p m. and 9 p. m T stands for "trace," less than 0 01 inch of daily rainfall. Temperature is given in degrees, Fahrenheit.

Table I shows the daily rainfall at the station during the year in inches and hundredths

Table II shows the daily mean temperature for 1892, and the normal mean temperature for each day, computed from ten years' record.

Table III gives a comparison of the monthly mean temperature, humidity and rainfall for the station and the state, with the ten-year averages for the same.

Table IV shows the rainfall at the station for each month during the last ten years

Table V contains the record of atmospheric pressure; the mean temperature, the highest and lowest temperature, with the range of temperature for each month, the number of clear, fair, cloudy and rainy days, the rainfall and prevailing direction of wind for both the Experiment Station and state.

Table VI contains the principal points of interest on the temperature, state of weather, and rainfall during the same period, and a grand summary for ten years.

I am indebted to the Ohio State Meteorological Bureau for the daily normal temperatures in table II, and for the statistics on the weather of the state.

METEOROLOGY—TABLE 1.

DAILY RAINFALL AND MELTED SNOW FOR 1892—AT EXPERIMENT STATION.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug	Sept.	Oct.	Nov	Dec.
1	.18	.....	.03	.....	T	.81	.....	1.20	.....	.....	.36	.....
2	16	.19	.....	.55	.43	.15	.16	.13	.....	.....	.22	.....
3	.02	.....	.....	.61	.16	T	1.22	.....	.....	T	.01	.....
4	10	T	T	T	.23	.06	.....	1.60	.....	.....	.....	.....
5	T	.45	.47	.31	.....	T	.....	.....	.18	.....	.04	.....
6	.30	.....	.....	.....	.02	.....	.....	.....	.....	.....	.....	0 60
7	T	.38	.....	.....	.....	05	.....	.....	.....	T	.07	0.16
8	10	.....	.12	.08	.....	1.91	.....	.....	.....	.32	.....	T
9	.....	.....	.18	.12	.....	.21	.....	.....	.....	.....	.27	.....
10	T	T	08	T	.25	.....	.....	T	.....	T	.....	.....
11	T	12	.02	.....	.01	.....	T	2.05	.....	.....	.....	.....
12	09	.05	.....	.....	T	.....	.....	.....	.08	.....	.....	.....
13	66	.....	.....	.....	15	.....	.19	.....	.77	.....	.....	.59
14	.14	.75	.02	.35	.33	.05	T	.....	.....	.....	.57	T
15	.....	.....	.....	02	.59	.42	.10	.....	.....	.....	.....	T
16	.....	T	.....	.....	.....	.....	.....	.....	.05	T	.....	.....
17	.....	.....	.05	T	.....	.09	.....	.....	.....	.....	.....	T
18	.30	.07	.02	.09	.79	.60	.....	.....	.....	.....	48	.....
19	.05	.76	.05	.....	.47	1.24	.68	.10	.....	.33	.39	.....
20	.....	.01	.....	.30	.41	T	.....	.....	.....	.02	.....	.....
21	.....	.....	.....	.10	.....	.57	.....	.....	.....	.....	.....	.....
22	.....	T	.26	.02	T	.03	.13	.....	T	.....	.....	.....
23	.....	.....	.28	.....	.07	.13	.....	.....	.....	.....	.....	0.01
24	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.03
25	.....	.01	.....	.....	.15	.....	.....	.03	.19	.....	.....	0.05
26	.....	T	T	.....	.41	.....	.17	.25	.....	.....	.02	.....
27	.....	.....	16	.....	T	T	.....	.55	.....	.....	.16	.....
28	.....	T	.....	.08	.06	.....	.....	.....	.....	.....	.03	.....
29	.....	.48	.....	.....	.10	.26	.48	.....	.....	.....	.....	.....
30	T	.....	.47	.....	.....	.15	.....	.24	.....	.....	.....	.....
31	.....	.....	.....	.....	.....	.....	T	.....	.....	.....	.....	0.38
Total	2.05	3 27	2.16	2.63	4.63	6.78	3.13	6.15	1.27	0 67	2 62	1 85
Average	.07	.12	.07	.09	.15	.22	.10	20	.04	.02	.09	.06

METEOROLOGY—TABLE II

DAILY MEAN TEMPERATURE FOR 1892—AT EXPERIMENT STATION.

N stands for Normal Mean Temperature for 10 years)

	January.		February.		March.		April.		May.		June.		July.		August.		September		October		November.		December	
	1892	N.	1892.	N.	1892.	N.	1892.	N.	1892	N.	1892.	N.	1892.	N.	1892	N.	1892	N.	1892.	N.	1892	N.	1892.	N.
1	50	35	40	28	30	30	63	46	71	49	74	64	62	72	68	74	57	62	62	60	55	48	28	31
2	24	24	39	33	26	31	62	46	67	57	70	65	69	72	68	73	59	66	53	58	57	47	37	31
3	18	24	34	34	31	30	60	44	67	59	68	66	61	72	73	71	68	67	70	57	50	44	38	34
4	25	27	34	32	45	28	71	46	66	61	71	67	68	72	66	70	73	68	58	55	42	43	36	34
5	22	28	19	28	35	27	67	44	71	59	72	68	68	72	67	70	65	67	42	54	31	44	34	34
6	21	26	22	28	33	32	47	42	65	59	75	69	69	74	75	70	56	66	45	53	44	41	50	36
7	14	23	48	35	42	32	50	45	52	56	69	68	69	74	77	70	64	68	58	54	55	47	56	36
8	24	27	33	32	42	31	42	43	48	59	68	69	72	72	78	72	66	66	46	52	34	46	35	36
9	8	23	28	29	38	34	30	44	61	62	69	70	70	71	82	74	72	68	48	52	32	48	32	35
10	14	23	34	31	18	32	34	48	62	63	69	68	72	71	77	72	72	66	50	54	28	44	29	36
11	32	26	26	31	24	37	34	49	51	59	74	68	74	72	74	71	74	66	52	54	35	44	23	35
12	28	27	14	28	42	37	37	50	48	60	78	70	77	74	68	72	67	67	54	55	36	40	28	33
13	26	27	29	31	29	34	44	50	57	60	80	71	74	72	66	70	62	65	56	55	45	40	42	36
14	16	25	38	34	22	35	39	53	65	59	76	72	75	73	66	70	56	62	54	51	46	38	38	36
15	10	26	25	32	24	34	39	52	64	60	76	74	78	73	69	70	57	65	65	49	41	38	33	31
16	12	27	22	34	28	35	45	50	60	56	82	75	62	73	74	71	60	65	66	49	45	40	34	31
17	26	25	29	36	23	35	49	54	65	60	78	76	66	74	74	72	58	62	56	54	53	40	35	30
18	26	22	38	33	22	39	45	52	66	64	75	74	69	72	75	71	64	64	67	53	37	37	32	29
19	9	24	43	33	26	37	44	54	54	61	72	73	73	70	70	71	66	64	52	52	29	34	32	27
20	7	26	38	29	30	33	46	55	53	60	75	71	72	70	74	72	66	62	50	46	28	37	21	29
21	17	19	40	28	32	32	57	56	52	60	75	72	76	72	73	73	65	61	51	46	30	39	22	32
22	30	23	44	30	46	34	49	54	48	62	76	71	78	75	71	69	70	63	53	45	27	40	19	30
23	27	28	42	30	34	34	54	55	52	62	80	71	83	75	73	68	70	61	45	45	22	38	20	34
24	34	26	47	38	37	40	44	50	59	58	78	72	86	74	71	65	71	61	40	44	25	36	12	33
25	34	28	40	36	48	43	47	51	62	62	69	69	82	74	74	66	71	62	38	45	30	35	14	31
26	11	24	38	31	50	43	52	54	52	60	69	71	79	74	68	68	56	61	42	46	32	36	12	28
27	13	27	39	29	40	42	67	58	53	60	67	69	81	75	68	68	53	59	43	47	34	35	17	27
28	32	28	44	29	38	38	59	55	60	61	68	72	82	74	69	64	58	60	53	44	34	30	20	27
29	38	30	37	28	43	38	50	54	65	62	70	69	78	74	74	68	62	59	41	45	34	30	16	29
30	32	30	...	...	49	42	56	56	69	64	67	71	72	75	69	66	63	60	37	42	33	30	21	30
31	32	31	...	...	52	44	...	...	76	63	...	...	74	76	59	64	...	...	50	45	...	...	31	36
Daily mean temperature	23	26	35	31	35	35	50	50	60	60	73	70	73	73	71	70	63	61	52	50	37	40	29	32

METEOROLOGY—TABLE III.

COMPARISON OF MEAN TEMPERATURE MEAN RELATIVE HUMIDITY AND RAINFALL FOR 1892.

	Jan.	Feb	March	April.	May.	June.	July.	Aug.	Sept	Oct.	Nov.	Dec.	Year.
Mean temperature at the station	23°	35°	35°	50°	60°	78°	73°	71°	63°	52°	37°	29°	51°
Ten-year average temperature at the station	26°	31°	35°	50°	60°	70°	73°	70°	64°	50°	40°	32°	50°
Mean relative humidity at the station (per cent.)	80	80	74	68	77	82	76	79	80	74	82	83	78
Ten-year average relative humidity at the station (per cent.)	87	85	80	74	77	79	76	78	78	79	82	83	80
Mean temperature for the state	24°	35°	35°	49°	59°	73°	73°	71°	64°	52°	38°	29°	51°
Ten-year average temperature for the state	27°	31°	35°	50°	60°	69°	73°	70°	64°	51°	41°	33°	50°
Mean relative humidity for the state (per cent)	83	84	82	74	80	79	78	78	78	76	87	84	80
Ten-year average humidity for the state (per cent.)	83	82	79	73	75	77	74	75	77	75	80	81	78
	Inches.	nches.	Inches.	Inches.	Inches.	Inches	Inches.	Inches	Inches.	Inches	Inches.	Inches.	Inches.
Rainfall at the station	2 05	3.27	2.16	2 63	4.63	6 73	3 13	6.15	1 27	0 67	2.62	1 85	37.16
Ten-year average at the station	3 02	5 06	4 26	2 08	3 05	4 12	4.28	2 27	1 17	2 59	5.43	2 42	39 75
Mean rainfall for the state	2 11	3 03	2 86	3 52	6.32	5 61	3 80	2 99	2 36	0 73	2 32	1.71	37 16
Ten-year average for the state	3 29	3.85	2 92	2 76	4 27	4 13	3.16	3 30	3 03	2 46	3.11	2.27	36 88

METEOROLOGY—TABLE IV.

MONTHLY RAINFALL FOR TEN YEARS.

Year.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	Total.
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
1883	2.90	5.81	2.87	2.98	5.76	4.70	2.92	2.12	3.13	4.34	3.87	4.97	46.37
1884	2.77	5.29	4.10	2.40	4.34	1.11	2.23	0.45	4.23	1.49	1.13	3.87	33 41
1885	4.03	3.17	0.98	4.51	5.92	4.84	3.01	5.50	2.00	3.12	2.89	1.68	41 65
1886	4.49	1.67	2 83	3.25	6.91	2.23	3.01	1.42	3.42	1 19	4 18	3.41	38 01
1887	1.54	6 85	2.84	4.45	4.36	5 47	1.56	2.47	1.82	0.38	2.64	2.04	36.62
1888	4.04	1.71	4.33	2.39	6 67	2.43	4.72	5.85	1.26	5.14	4.30	1 36	44.20
1889	3 90	0.81	1.00	1.11	3 46	2.08	2.85	2.07	3.77	1.79	3.72	2.24	28 80
1890	5.50	5.88	4 88	4.08	4.69	5 43	1.41	3.71	8.16	2.71	1.76	2 38	50 59
1891	3.13	5.26	4.38	2.02	2.87	3.83	4.41	1.84	1.16	2.80	5 74	2.42	39.86
1892	2 05	3 27	2.16	2.63	4.63	6 73	3 13	6.15	1 27	0 67	2 62	1 85	37.16
Average	3.53	3.88	3.05	2 97	4.96	3.89	2 90	3.15	3 19	2 36	3.11	3 09	39 67

METEOROLOGY—TABLE V.—SUMMARY BY MONTHS FOR 1892.

	Barometer.						Mean relative humidity			
	Mean	Highest	Date.	Lowest.	Date.	Range		Mean.	Highest	Date
At the Experiment Station										
January	30 16	30 64	16th	29 55	1st	1 11	80	23	55	1st
February	30 12	30 68	16th	29 39	11th	1 29	80	35	62	21th
March	30 08	30 52	[1]	29 37	8th	1 15	74	35	65	26th
April	30.08	30 45	25th	29 68	11th.	0.77	68	50	78	[3]
May	29.95	30 29	8th.	29 55	19th.	0.74	77	60	86	31st
June	29.93	30 10	13th	29 60	27th	0.50	82	73	92	16th
July	30 07	30 15	7th	29 77	3d	0.68	76	73	95	24th
August	30 03	30 16	16th.	29 75	24th.	0 41	79	71	90	[8]
September	30.11	30 37	2d	29.41	13th	0.96	80	63	86	10th
October	30 10	30.44	30th.	29 61	7th	0.83	74	52	83	[11]
November	30.12	30 48	22d	29.39	17th.	1.09	82	37	69	17th
December	30 16	30 61	11th.	29 53	7th.	1.08	83	29	64	7th
Sums and averages	30 02	30 68	Feb 16	29.37	Mar. 8.	0 88	78	50	95	July 24
For the State										
January	30 13	30 70	16th.	29.37	6th	1.33	83	24	61	1st.
February	30 13	30.78	17th.	29 31	11th.	1.47	84	35	74	23d
March	30 09	30 59	21st.	29 31	8th,	1.28	82	35	80	31st
April	30 07	30 54	25th.	29 64	[5]	0.90	74	49	90	[6]
May	29 97	30.47	8th	29 38	19th	1.09	80	59	99	31st.
June	29 96	30 18	[7]	29 50	27th	0 68	79	73	101	17th
July	30 08	30 51	7th	29 71	3d	0 80	78	73	103	25th
August	30 02	30 22	16th	29 69	24th	0 53	78	71	99	16th
September	30 13	30 39	30th	29 37	13th	1.02	78	64	96	9th
October	30 08	30 52	30th	29.40	28th	1.12	76	52	89	3d
November	30 09	30 60	8th	29 28	17th.	1.42	87	38	76	2d
December	30 15	30 71	11th	29.40	[11]	1 31	84	29	70	[12]
Sums and averages	30 08	30 78	Feb 17.	29 31	Feb 11. Mar 8	1.06	78	50	103	July 25.

Station—[1] March 14th and 21st. [2] March 10th, 11th and 14th [3] April 1st and 5th [5] August 8th and 9th. [6] August 1st and 9th. [10] Sept. 13th and 21st. [11] October 1st, 3d

State—[1] January 13th, 19th, 23d and 26th. [2] February 5th and 6th. [3] February 3d, 12th and 25th. [6] October 1st and 9th. [9] October 8th, 25th and 29th. [10] November 3d, 12th and

METEOROLOGY—TABLE V.—SUMMARY BY MONTHS FOR 1892

Temperature								No. of days				Monthly rainfall	Average daily rainfall	Prevailing wind
Lowest	Date	Range	Mean daily range	Greatest daily range	Date	Least daily range	Date	Clear	Fair	Cloudy	Rain fell			
18	20th	73	17	44	20th	5	th	9	12	10	11	2 0	07	S W
0	6th	69	17	37	6th	1	d	6	8	1	11	[illegible]	1[illegible]	[illegible]
15	2	5[illegible]	18	35	25th	7	18th	9	11	11	14	[illegible] 16	07	[illegible]
-	9th	56	21	36	1st	10	4	8	13	9	12	2 63	09	N E
	8th	51	20	32	6	10	6	8	12	11	17	4 63	15	S
1	26th	38	19	28	13th	10	18th	5	21	4	16	6 75	22	S
4	2d	48	21	30	7	5	0th	9	20	2	8	1	10	S W
18	31st	42	22	32	10th	11	9	9	20	2	9	0 15	20	N
4	27th	52	27	40	3d	12	10	17	11	2	5	1 47	04	S W
-	30th	51	29	44	19	11	25th	14	13	4	3	0 67	02	N W
5	20 h	61	16	34	13th	3	5th	9	13	5	12	[illegible] 62	01	N W
0	6th	64	14	29	2d	4	11th	3	16	10	[illegible]	1 85	06	W
18	Jan 20	113	20	44	12	4	Feb 3 Dec 14	108	170	88	120	[illegible] 16	10	S
3	20th	86	16	47	19th	2	1	9	9	13	11	2 11	07	S W
1	2	71	16	43	5th	2	3	5	8	16	11	3 03	10	S
6	4	74	17	43	25th	2	23d	7	11	13	13	[illegible] 86	09	N W
14	19th	76	21	50	1st	2	18th	8	11	11	10	3 32	11	N W
8	8th	71	20	47	5th	2	19th	6	11	14	17	6 32	21	S W
47	29th	54	20	39	13th	3	3d	9	13	8	15	5 61	19	S W
40	17th	63	22	46	7th	1	29th	15	12	4	8	3 80	12	S W
45	29th	54	21	41	31st	3	5th	15	11	5	7	2 39	10	S W
4	27th	62	24	51	25th	3	5th	16	10	4	6	2 36	08	S W
20	30th	69	23	48	8	2	9	12	11	8	5	0 73	02	N W
8	11th	68	15	48	5th	1	10	4	10	16	11	2 32	08	N W
—12	28th	82	15	39	9th	1	17th	5	9	17	7	1 71	06	W
—25	Jan 20t	128	19	61	Sept 25	1	July 29 Nov 3 12 28 Dec 12	111	126	129	121	37 16	10	S W

*4 April 8th and 20th *5 May 1st and 9th *6 May 4th and 19th *7 July 2nd and 27th and 8th *13 October 14th and 18th and 20th *4 March 11th and 14th *5 April 4th and 5th. *6 April 4th and 5th. *7 June 11th 8th *11 December 7th, 8th, *12 Dec , 11th and 12th.

METEOROLOGY.—TABLE VI.—SUMMARY BY YEARS AND GRAND SUMMARY FOR TEN YEARS.—*Part First.*

	1883.	1884.	1885.	1886.	1887
At the Experiment Station					
Mean relative humidity	82.3 per cent.	82.3 per cent.	84.2 per cent	82.7 per cent.	79 2 per cent.
Mean temperature	49.1°	50 1°	47.4°	49.2°	50.8°.
Highest temperature	97.0°, August 22	97.0°, August 20	101.0°, July 21	97 5°, June 4	102 5°, July 17.
Lowest temperature	—7.0°, January 12	—32 0°, January 25	—20.0°, Feb. 21	—12.0°, Feb. 17	—10 0°, Jan. 11.
Range of temperature	104.4°	129 0°	121 0°	109 5°	112 5°.
Mean daily range of temperature	22.9°	24.8	23.1°	23.6°	24 1°.
Greatest daily range of temperature	45°, September 11	49.5°, July 22	55.0°, Feb. 2	48 0°, Feb. 17	47.5°, Sept. 5.
Least daily range of temperature	1. 8° January 28	4.0°, Feb. 22	4 0°, Dec. 10	5 0°, Feb. 7	3 0°, Dec. 12.
Number of clear days	105	103	83	107	98
Number of fair days	147	119	137	145	130.
Number of cloudy days	113	144	145	113	137.
Number of days rain fell	165	149	166	154	158.
Total rainfall	46.37 inches	33 41 inches	41 65 inches	38.01 inches	36 62 inches.
Mean daily rainfall	0.127 inch	0.091 inch	0.114 inch	0.104 inch	0 100 inch.
Greatest monthly rainfall	5.81 inches, Feb.	5 29 inches, Feb.	5 92 inches, May	6.91 inches, May	6 85 inches, Feb.
Least monthly rainfall	2.12 inches, Aug.	0.45 inch, Aug.	0 98 inch, March	1.19 inche, Oct.	0 38 inch, Oct.
Warmest day of year	82.7°, July 23.	80 5°, July 23.	85. 8°, July 31	81.9°, July 29	87 0°, July 17.
Coldest day of year	1 0°, Jan. 22.	—16 8°, Feb. 6	—4.0°, Feb. 10	—5.05°, Jan. 10.	0 6° Jan. 10.
Prevailing direction of wind	N. W.	S. W.	S. W.	S. W.	S. W.
For the State.					
Mean relative humidity	76.3 per cent.	76.8 per cent.	77.5 per cent.	77.8 per cent.	75.8 per cent.
Mean temperature	49.4°	50.6°	48.0°	49.6°	51 4°.
Highest temperature	98°, August 22	99 0°, Sept. 28 and O t. 1	101 0°, July 21	98.6°, July 7.	108.0°, July 18.
Lowest temperature	—17.2°. Jan. 22.	—34.0°, Jan. 25.	—31.0°, Jan. 29	—21.5°, Jan. 12	—21 0, Jan. 7.
Range of temperature	115.5°	133.0°	132.0°	120.1°	129.0°.
Mean daily range of temperature	19.8°	20.5	20.4	20.2°	21.2°.
Greatest daily range of temperature	55.2°, March 18.	50 0°, Sept 5 and Dec. 4	58 5°, Jan 30	57.0°, Dec 11	57 0°, April 11
Least daily range of temperature	0 5°, December 23.	1.1°, Feb. 6	1.0°, Apr. 18 and Dec. 31	1 1°, March 27	1 0°, Jan. 15 and Apr. 16.
Average number of clear days	98.2	116.7	103.5	118.4	113.8.
Average number of fair days	135.4	118.3	132.8	125.7	127 3.
Average number of cloudy days	130.4	131.1	128.2	121.0	123.9.
Average number of days rain fell	146 0	145.0	147.7	130.7	120 9
Mean yearly rainfall	44.98 inches	40 19 inches	38.08 inches	36 71 inches	33 63 nches.
Mean daily rainfall	0.123 inch.	0.110 inch.	0 104 inch	0 100 inch	0 092 inch.
Prevailing direction of wind	S. W.	S. W.	S. W.	S. W.	S. W.

	1888.	1889.	1890.	1891.	1892.	Sum'ary for ten years.
At the Experiment Station.						
Mean relative humidity	82 8 per cent.	79.8 per cent.	78.5 per cent	77 per cent	78 per cent.	81 per cent.
Mean temperature	49.6°	51.2°	52 3°	51°	50°	50°
Highest temp rature	98.0°, June 20	93 0° Aug 31 and Sept. 1	95.0°, July 8 and 15	94°, Aug. 9 and 10	95°, July 25	102.5°, July 17, 1887
Lowest temperature	—11.0[a], Jan. 28	1.0°, Feb. 23	4.0°, March 6	—2°, March 5	—18°, Jan. 20	—32°, Jan. 25, 1884
Range of temperature	109.0°	92.0[b]	91 0[b]	96°	113	134 5°
Mean daily range of temp	21 1°	20.8°	19.1°	21°	20°	22°
Greatest daily range of temp	43.2°, April 28	41.5°, April 23	41 0°, January 13	43°, Oct. 17	44°, Oct. 14, 18	55°, Feb 2, 1885
Least daily range o. temp	4.1°, Aug 21	3.0°, Jan. 6 and Nov. 20	2 0°, December 17	3° Jan. 18	4°, Feb. 3, Dec. 14	1.8°, Jan 28, 1883
Number of clear days	96	121	115	142	108	108
Number of fair days	141	113	125	119	170	135
Number of clondy days	129	128	125	104	88	122
Number of days rain fell	142	163	163	131	125	152
Total rainfall	44.20 inches.	28.80 inches	50 59 inches	39 86 inches	37 16 inches.	39 67 inches
Mean daily rainfall	0 120 inch	0.079 inch	0.139 inch	0 11 inc	0.10 inch	0.11 inch
Greatest monthly rainfall	6.67 inches, May	3.90 inches in January	8.16 inches in Sept.	5.74 inches in Nov	6 73 inches, June	8 16 inches
Least monthly rainfall	1.26 inches, Sept.	0.81 inches in February	1.41 inches in July	1.16 inches in Sept.	0.67 inches, October	0.38 inch in Oct , 1887.
Warmest day of year	84.1°, June 20	80 5°, July 9	86.1°, July 30	86°, Aug. 10	86°, July 24	87°, July 17, 1887
Coldest day of year	7.5° Feb. 9	4.9°, February 23	12 8°, March 6	12°, Feb. 4	7°, Jan. 20	—16 8°, Feb. 6, 1884
Prevailing direction of wind	S. W.	S. W.	S	S	S. W.	S. W.
For the State.						
Mean relative humidity	78.2 per cent.	79.4 per cent.	80.2 per cent.	78 per cent	78 per cent.	78 per cent.
Mean temperature	49 5°	51.1°	52 4°	52°	50°	50°
Highest temperature	102 0°	99.5°, August 31	103 1°, August 3	101°, Aug 10	103°, July 25	108°, July 18, 1887
Lowest temperature	—15.0°, Jan. 27	—13 5°, February 24	—4°, March 7	—5°, March 5	—25[b], Jan. 20	—34[b], Jan. 25, 1884
Range of temperature	117°	113 0°	107.1°	106°	128°	142°
Mean daily range of temp	19.6°	19.3°	19°	20°	19°	20°
Greatest daily range of temp	50.0°	53.0°, March 30	49.5°, April 11	50°, April 27 and 30	51°, Sept. 25	58 5°, Jan. 30, 1885
Least daily range of temp	1 2°, Jan 16	1.0°, January 5	1.0°, December 17	2°*	1°†	0.5°, Dec. 23, 1883
Average n mber of clear days	108.7	112.8	103 4	153	111	112
Average number of fair days	123.4	113 8	121.6	109	126	123
Average number cloudy days	133 9	138 4	140 3	1 17	129	131
Average number days rain fell	124 7	114 8	149 4	120	121	132
Mean yearly rainfall	39.64 inches	33 53 inches	50.23 inches	38.61 inches	37.16 inches	39.28 in hes
Mean daily ralnfall	0.108	0.092 inch	0.138 inch.	0 11 inch	0.10 inch	0 11 inch
Prevailing direction of wind	S. W.	S. W.	S. W.	S. W.	S. W.	S. W.

*January 4 and 11; March 19 and 22; November 12; and December 4.

†July 29; Nov. 3, 12, 28; Dec. 17.

NOTES ON THE WEATHER AT THE STATION.—SUMMARY BY MONTHS.

JANUARY.

The mean temperature was 23°, 3° below the station average for January The highest temperature, 55°, occurred on the 1st, the lowest, —18°, on the 20th.

The mean relative humidity was 80 per cent. Fair weather prevailed. Rain and snow fell on eleven days. The total snowfall for the month was 12.40 inches; the total rain and melted snow, 2.05 inches, which is 1 38 inch below the station average for January. The greatest daily rainfall was 66 inch, on the 13th.

Lunar halos occurred on the 9th, 14th, and 16th.

Sleet occurred on the 12th, 13th, and 14th.

The prevailing wind was southwest.

FEBRUARY.

The mean temperature was 35°, 4° above the station average for February. The highest temperature, 62°, occurred on the 24th; the lowest, 0°, on the 6th.

The mean relative humidity was 80 per cent. Cloudy weather prevailed. Rain and snow fell on eleven days. The total snowfall for the month was 6.0 inches; the total rain and melted snow, 3.27 inches, which is .57 inch below the station average for February. The greatest rainfall in 24 hours was .76 inch on the 19th

An aurora occurred on the 13th

The prevailing wind was south.

MARCH.

The mean temperature was 35°, which is the station average for March. The highest temperature, 65°, occurred on the 26th; the lowest, 13°, on the 10th, 11th and 14th.

The mean relative humidity was 74 per cent. Cloudy weather on eleven days; fair weather on eleven days. Rain and snow fell on fourteen days. The total snowfall was 2.40 inches; the total rain and melted snow 2.1 inches, which is .79 inch below the station average for March. The greatest rainfall in 24 hours was .47 inch on the 5th and 30th.

The prevailing wind was north.

APRIL.

The mean temperature was 50°, which is the station average for April. The highest temperature, 78°, occurred on the 1st and 5th; the lowest, 22°, on the 8th.

The mean relative humidity was 68 per cent. Fair weather prevailed. Rain and snow fell on twelve days. The total snowfall for the month was 1.40 inch; the total rainfall, 2.63 inches, which is 0.34 inch below the station average for April. The greatest daily rainfall was 0.61 inch on the 3d.

Thunder storms occurred on the 3d and 4th.

Lunar halos occurred on the 6th, 7th and 11th.

The prevailing wind was northeast.

MAY.

The mean temperature was 60°, which is the station average for May. The highest temperature, 86°, occurred on the 31st; the lowest, 35°, occurred on the 8th.

The mean relative humidity was 77 per cent. Fair weather prevailed. Rain fell on seventeen days. The total rainfall for the month was 4.63 inches, which is .33 inch below the station average for May. The greatest rainfall in 24 hours was 0.79 inch, on the 18th.

A light frost occurred on the 8th.

Thunder storms occurred on the 2d, 3d, 4th, 18th and 26th.

The prevailing wind was south.

JUNE.

The mean temperature was 73°, which is 3° above the station average for June. The highest temperature, 92°, occurred on the 16th; the lowest, 54°, on the 26th.

The mean relative humidity was 82 per cent. Fair weather prevailed. Rain fell on sixteen days. The total rainfall for the month was 6.73 inches, which is 2.90 inches above the station average for June. The greatest rainfall in 24 hours was 1.91 inch, on the 8th.

Thunder storms occurred on the 1st, 2d, 7th, 8th, 14th, 15th, 17th, 18th, 19th, 21st, 29th and 30th.

The prevailing wind was south.

JULY.

The mean temperature was 73°, which is the station average for July. The highest temperature, 95°, occurred on the 24th; the lowest, 47°, on the 2d.

The mean relative humidity was 76 per cent. Fair weather prevailed. Rain fell on eight days. The total rainfall for the month was 3.13 inches, which is 0 23 inch above the station average for July. The greatest rainfall in 24 hours, 1 22 inch, occurred on the 3d.

An aurora occurred on the 16th.

The prevailing wind was southwest.

AUGUST.

The mean temperature was 71°, 1° above the station average for August. The highest temperature, 90°, occurred on the 8th and 9th; the lowest, 40°, on the 31st.

The mean relative humidity was 79 per cent. Fair weather prevailed. Rain fell on nine days. The total rainfall for the month was 6.15 inches, which is 3.00 inches above the station average for August. The greatest rainfall in 24 hours, 2.05 inches, occurred on the 11th.

The prevailing wind was north.

SEPTEMBER.

The mean temperature was 63°, 1° below the station average for September. The highest temperature, 86°, occurred on the 10th; the lowest, 34°, on the 27th.

The mean relative humidity was 80 per cent. Clear weather prevailed. Rain fell on five days. The total rainfall for the month was 1.27 inch, which is 1.92 inch below the Station average for september. The greatest rainfall in 24 hours, 0.77 inch, occurred on the 13th.

A heavy frost occurred on the 27th.

A thunder storm occurred on the 25th.

The prevailing wind was southwest.

OCTOBER.

The mean temperature was 52°, 2° above the station average for October. The highest temperature, 83°, occurred on the 1st, 3d and 8th; the lowest, 22°, on the 30th.

The mean relative humidity was 74 per cent. Clear weather prevailed. Rain fell on three days. The total rainfall for the month was 0.67 inch, which is 1.69 inch below the station average for October. The greatest rainfall in 24 hours, 0.33 inch, occurred on the 19th.

Light frosts occurred on the 11th and 13th.

Heavy frosts occurred on the 12th, 20th, 24th, 28th, 30th and 31st.

The prevailing wind was northwest

NOVEMBER.

The mean temperature was 37°, which is 3° below the station average for November. The highest temperature, 69°, occurred on the 17th; the lowest, 8°, on the 20th.

The mean relative humidity was 82 per cent. Fair weather prevailed. Rain and snow fell on twelve days. The total snowfall for the month was 6.80 inches; the total rain and melted snow, 2.62 inches, 0.49 inch below the station average for November. The greatest rainfall in 24 hours, 0.57 inch, on the 14th. Snow fell on the 8th.

The prevailing wind was northwest.

DECEMBER.

The mean temperature was 29°, which is 3° below the station average for December. The highest temperature, 64°, occurred on the 7th; the lowest, 0°, on the 26th.

The mean relative humidity was 83 per cent. Fair weather prevailed. The total snowfall for the month was 5.0 inches; the total rainfall and melted snow, 1.85 inches, which is 0.70 inch below the station average for December. The greatest rainfall in 24 hours, 0.60 inch, occurred on the 6th.

The prevailing wind was west.

F. J. FALKENBACH, *Meteorologist.*

ERRATA.

Page 21, omit decimal point in third column of table III.

Page 122, for *Dissosteia*, read *Dissosteira*,

Page 126, for *Agrostis*, read *Agrotis.*

Page 127, for *Aphodius sewal*, read *A. serval;* for *Lacnosterna*, read *Lachnosterna.*

Page 128, for *Luperus thoracious*, read L. *thoracicus;* for *Rhyncophora*, read *Rhynchophora.*

Page 134, for *Uromyces polygonia, Pers.*, read *U. Polygoni* (Pers.) Fckl.; for *U. trifolii* Alb. and Schw., read *U. trifolii* (Hedw, f.) Lev.

Page 135, for *Puccinia Marie-Wilsonii* (?), read *P. Mariæ Wilsoni* (Clinton) (?); for *P. Maydis*, Carradori, read *P. Maydis*, Berenger.

Page 137, for *Phragmidium fragariæ* (DC) Rosm., read, P. *fragariæ* (DC) Wint.; for *Melampspora populina*, Wint., read *M. populina* (Jaq.) Lev.

Page 138, for *Æcidium grossulariæ*, Schnm., read *Æ. grossulariæ.* D C.; for *Æ. geranii, read Æ. geranii*, DC.

Page 139, for *Æ œnotheræ*, read *Æ. œnotheræ*, Pk.; for *P. hastata*, read *P. hastata* Cke.; for *P. solida*, read *P. solida*, S.

Page 159 line nine from top, for LEPEDOPTERA, read LEPIDOPTERA

Page 140, for *P. saniculæ, read saniculæ*, Grev,; *for Coleosporium compositarum*, read *C. compositarum*, Lev.; for *Aster punicens*, read A. *puniceus;* for *Uredo filicum*, read *U. filicum*, Chev.; for *Æcidium compositarum*, read *Æ. compositarum*, Mart.; for *Æ. compositarum*, var. *eupatoriæ*, read *Æ. compositarum*, Mart. var. *enpatoriæ* (S) B.; *for Æ. cimicifugatum*, read *Æ. cimicifugatum*, S.

Page 153, line six from top, for say, read Say.

Page 161, line seven from top, for Obeira, read Oberea.

Page 166, line fifteen from bottom, for LEPIDOBTERA read LEPIDOPTERA.

Page 173, line nineteen from top, for *xylineformis*, read *xyliniformis.*

Page 178, line fifteen from top, for *glancaria*, read *glaucaria;* line one from bottom. for *glancaria*, read *glaucaria.*

Page 188, line seventeen from bottom, for *nemnralis*, read *nemoralis.*

Page 208, line five from top, for sufficinetly, read sufficiently.

Page 211, line seventeen from bottom, for FLEE, read FLEA; line twenty from bottom, for fiy, read fly, and for Tabinus, read Tabanus.

Page 234, line thirteen from top, for *and*, read and.

INDEX.

(ARTICLES MARKED ' ARE ILLUSTRATED.)